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J. M. WAKEMAN, - - - - - - - President and General Manager.

CHICAGO OFFICE, - - - - - - - - - - 1139 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - - - - 929 Chestnut Street.

EUROPEAN OFFICE, - - - - - - - - - - A. C. Shaw, Manager.
Hastings House, Norfolk St., Strand, London, England.

T. C. MARTIN AND W. D. WEAVER, - - - - - - - - - Editors.
T. R. TALTAVALL, - - - - - - - - - - - - Associate Editor.

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AUTOMOBILE RECORDS.

Our opinion as to the waste of time in automobile racing, so far as the permanent advance of the art is concerned, has been frequently and vigorously expressed, but we are, nevertheless, willing to admit that such races and records as those of last Saturday do make the blood tingle. We report elsewhere in this issue the contests on the Coney Island Boulevard, where, under the auspices of the Long Island Automobile Club, all the existing world records were smashed to pieces. It was a decidedly new experience and sensation to see huge machines, under perfect control, flying over the surface of smooth roads, at speeds of 70 miles an hour. To say nothing of the qualities in the machine, it takes nerve and skill to handle a vehicle going free at that gait; and the public interest in such performances is not to be gainsaid. We note with pleasure the brilliant record made by Mr. Riker, whose electric racer, stealing swiftly past, like a thief in the night, was conspicuous for its quietness as compared with the unloosened rattling avalanches, the gasolines, shaking the ground like flying earthquakes. A mile a minute for an electric automobile—and an American machine at that—is not to be despised.

But we doubt that a great industry can be built up on racing. Probably several American manufacturers will build machines to beat the record, and will not be happy until they do it; yet the great field for exploitation is that of the humble drudgery of pulling and hauling. Such beautiful animals as are being exhibited at the Horse Show this week will long continue to enjoy the love and patronage of the wealthy sportsman, but even at the Show one can hear utterances that reveal the firm conviction as to the desirability and inevitability of the automobile for "work." The automobile industry is still in an immature condition, although the strides of progress are being rapidly made. It will soonest reach the status of a staple and permanent and profitable business by getting itself hitched to the demands of heavy and regular transportation. Even then there will always remain plenty of sport and speed to be got out of it.

PACIFIC CABLES.

It is evident that the Commercial Pacific Cable Company does not intend to let matters slumber in regard to its new cable. The announcement of its plans is still fresh in mind when the news comes of the award of a contract for the first section of the line to the Hawaiian Islands, which, we learn upon inquiry, it intends to have in operation about next October—say, a year from now. This is quick work, and would imply that the fortunate recipients of the contract, the India Rubber, Gutta Percha & Telegraph Works, of Silvertown, are ready to do some "tall hustling." The cost of making and laying this section is put at about $3,000,000. The whole Commercial undertaking is put at about $15,000,000.

It is already known that England will have her Pacific cable to the Far East, and that work in such quarters has already begun; hence with the two services in existence, as they undoubtedly will be within another year or two, it is difficult to see how any third project can be carried through with great hope of financial success. There is a scheme which involves a subsidy or may result in an American Government cable, and it is coming before Congress this winter. We are open to conviction, but with these two other cables already building, we can hardly see why a third cable should be subsidized or why the Government should itself embark in the cable industry. In fact, Mr.

Mackay's readiness to go ahead without a subsidy is very creditable, to say the least, to his nerve and enterprise.

There is one point in the matter that Mr. George G. Ward, first vice-president of the Commercial Cable Company, touches upon in an interview, which strikes us as quite important. He thus explains why American money is being spent abroad for the work: "The Commercial Pacific Cable Company would have been very happy to have given an American company its contracts, but there is no company in the United States that could, we felt, perform the work. They have not the machinery, and we could not afford to have the work of laying the cable take the form of an experiment. The Silvertown Company has been established for over 40 years, and has laid most of the deep ocean cables throughout the world, so that it understands perfectly just how the work should be accomplished. The company has assured us that they will complete the cable and have it here in seven months." Now we must accept Mr. Ward's statement as true, and being true, it is cause for congratulation to our English friends that they thus more than hold their own in the great domain of submarine telegraphy. There were, in fact, three or four English bidders equal to the job. But we must confess that it would have been a keen pleasure to record the fact that American skill not less than American capital were engaged on this great work, which means so much in future relationships between this country and Asia, Australasia, India and all the land of Cathay. These cable plans now being executed by Englishmen are among the greatest of the age, and are equaled only in their class by the great Cape-Australian cable of some 15,000 miles, lately noted in our columns. One hears of French and German projects, but in the meantime England has her cables "in being," which means a good deal to her as well as to the rest of the world.

Three-Phase Traction Motors.

An article abstracted in this week's Digest on a Swiss polyphase railway is noteworthy as containing the first definite published statements regarding certain features of practical three-phase traction. The report from two and a half years' operation of the Burgdorf-Thun line, of literally no repairs to the motors, is both striking and encouraging. Many engineers have predicted that he who used three-phase motors on cars would find himself constantly between the devil and the deep sea—on the one hand eternal trouble due to the small air-gap, on the other enormously heavy currents in starting and acceleration. Brown, Boveri & Co. state squarely and without qualification that the small size of the clearance has caused not a minute's stop, and that the whole motor equipment has been free from trouble of all kinds. Moreover, for the first time we find data on the current taken by such motors during acceleration. The figure given for the Burgdorf-Thun trains is 1½ ft. per second (per second), which is certainly enough to meet ordinary conditions well, and the statement is made that this is accomplished without exceeding the normal—presumably full-load—current. This is, of course, more or less *ex parte* testimony, but it comes from a very reliable quarter, and it is not too much to say that the results attained on this now well-tested road have been such as to be very encouraging to engineers working along this particular line. It has regularly happened in the development of induction motors that bugbears of theory have vanished as the practical art has advanced to the attack. The extension of induction motor practice to tramway work was a serious step, calling for skill and courage, but the preliminary advance seems to have been successful to a very gratifying degree. That the larger work contemplated or recently undertaken abroad involves more serious problems than any hitherto faced, is true, but the inherent probabilities of the case seem to indicate that the chance of failure is rather remote.

Electrical Surges.

We commend the admirable article of Dr. Kennelly, printed elsewhere in this issue, to the reader who wishes to inform himself on the very interesting subject of electrical oscillations in circuits containing inductance and capacity. While the recent Institute paper of Mr. Steinmetz treated the subject in a most masterly manner, yet its mathematical character and condensed style render the reading of the paper difficult to those who approach the subject for the first time. That the subject may be set forth in the simple terms which Dr. Kennelly employs gives rise to reflections on the manner in which so much of the science of variable currents has in the past been sealed from all but the elect, through the employment of the methods of higher mathematical analysis. Indeed, it is in one sense a misfortune that for a long period of time this branch was a favorite field for the mathematical physicist. Had its cultivation been deferred until the entry of alternating currents into engineering, the development would have been along quite different lines. At the present time a great opportunity awaits the author who will put forth a book in which the whole subject of variable currents shall be treated in a manner conforming to the processes, not of the mind of the mathematical physicist, but that of the engineer.

As is made clear by Dr. Kennelly, some of the phenomena which have been observed in connection with long-distance transmission, and which have hitherto defied explanation, are quite simply elucidated when the proper principles, as developed in the article, are borne in mind. In the past such names as static and resonant effects have been applied to some of these phenomena, but, as Dr. Kennelly points out, it is quite probable that in most cases these designations are misnomers and that the effects were probably due to electrical surgings. The article possesses an additional interest from the illustrations it involves as to the mechanism of the actions resulting from the presence of inductance and capacity in a circuit. These actions, which give rise to surgings and which at first sight appear singular, are more readily understood if it is borne in mind that the reactance of a condenser is always opposite to that of an inductance. Thus when an inductance discharges, it charges a condenser in relation with it; the latter then in turn is discharged through the inductance, which again discharges into the condenser, and so on until the original energy is dissipated by resistance, in hysteresis and parasitic currents. The analogue of such a circuit is thus a vibrating spring, such as a tongue fixed at one end, the electromagnetic energy of the circuit under normal regime corresponding to the initial energy imparted to the spring, and its molecular friction and air resistance to the current-dissipating properties of the electrical circuit. The fact that a smaller capacity gives rise to a greater strain is easily understood when it is recalled that the e. m. f. of a condenser is directly proportional to the charge imparted to it; consequently, for a given surging current, the charge imparted will be greater the smaller the condenser, since it has to receive a quantity in proportion to the value of the current.

The Zossen High-Speed Experiments.

A note in the daily press, wandering from paper to paper within the last week, gives hope of some definite results being made public ere long concerning the Zossen polyphase traction trials. The report states that a speed of 105 miles per hour had been successfully reached, and then goes wandering off into incoherent details of the alleged air pressure found at this "hitherto unrecorded speed." We have many friends connected with the daily press, and we wish them well, but we hope that in some not distant day they will become more careful in their treatment of scientific matters. As to the speed attained we doubt not that the report is correct, for there is certainly no good reason why it should not be; but so far from its being the

highest speed yet attained by anything of human contrivance save projectiles, the figure named has been equaled or exceeded on this side of the water at least half a dozen times. In the experiments with the Weems high-speed road a decade ago, 105 miles per hour was at times materially exceeded by the light car employed, and in ordinary railroading locomotives with short trains have repeatedly made the measured mile in less than 40 seconds, the record, we believe, being 32 seconds, which has been closely approached several times. The time will have to be clipped to 30 seconds or thereabouts before the record can be carried across the water. We have no doubt that the Zossen experimenters will turn the trick in due season, and when they do so they shall have our sincerest congratulations, but the record is so far intact.

SOLAR ACTIVITY AND TERRESTRIAL MAGNETICS.

A paper was recently read by Sir Norman Lockyer before the Royal Society of Great Britain upon the "Solar Activity During the Period 1833-1900." In this paper the records of the number and area of sunspots are analyzed and compared during the last two-thirds of the nineteenth century. The results go to show that the sun may be regarded as a variable star, its luminous radiation undergoing periodic variation within a small range. The mean time separating maximum or minimum of sunspots is well known to be about eleven years, and at the present time we are just about the epoch of the sunspot minimum. Superposed upon the eleven-year maximum-minimum pediod there is, according to Lockyer's analysis, a further period of approximately 35 years. The course of magnetic variations continued from year to year seem to indicate in a corresponding manner the influence of both the 11-year cycle and a 35-year cycle. An analysis of frequency of the aurorea borealis is stated also to show the existence of a 35-year cycle.

The most interesting circumstance, however, to which attention is called, is the agreement of this 35-year period of terestrial sunspot variation with the results of terrestrial climatology, as investigated of recent years by Bruckner. It seems that Professor Bruckner has made a careful examination of meteorological records during the past 200 years, and finds, as a general result, that there is a small periodical variation in the climates over the whole earth, the mean length of this period being 34.8 ± 0.7 years. Moreover, the curve of variation in annual rainfall shown, as taken from Bruckner's work, closely follows the 35-year sunspot variation curve, indicating a general slight increase in rainfall during the years of maximum sunspot development, or when the solar radiation is at its minimum, and on the contrary, a reduced annual rainfall when the sunspot development is least in the 35-year cycles. At the present time we appear to be in the neighborhood of a minimum rainfall on this cycle. It is stated that a 33 or 34-year cycle period has been independently traced in the climatology of Sydney, Australia, and also a 35-year period in the movements of glaciers by Professor Richter.

It is, of course, only reasonable to expect that cyclic changes in the sun's activity should repeat themselves in the earth's meteorology, but the fact that the changes in the seasons are so slight as to escape ordinary observation from decade to decade, is sufficient to show how small is the range of variation in either. It is very common to hear people speak casually about variations in climate, which have occurred at some particular locality to their own knowledge within the limits of their lives, but in every case a careful examination of meteoroligical records made during the period referred to fails to establish any such supposed variation, and the mean annual temperature or rainfall is a wonderfully steady quantity in the long run, although so manifestly subject to numerous temporary fluctuations. The predetermination of weather and climate is necessarily of enormous consequence and value to a community, and if the 35-year period of Sir Norman Lockyer is confirmed by subsequent analysis, it must prove of great interest, even if the range of variation be minute.

THE HEYLAND POLYPHASE MOTOR.

The attention of our readers was called some months ago to the proposal of Mr. Heyland to produce a polyphase motor of unit-power-factor; that is to say, a motor which acts as though devoid of self-inductance, or requires no wattless component of magnetizing current. This consummation devoutly to be wished, was, in brief, to be sought by placing a commutator on the secondary rotor, and directing the positions of the poles thereon, by means of brushes. The reasoning involved is that if synchronism were obtained, the multiphase currents supplied from the commutator to the secondary would produce about it a rotating field advancing, say, clockwise, while the rotation of the secondary itself at synchronous speed, counter-clockwise, would cancel this rotation and leave the poles stationary with respect to its own windings. There was to be no self-induction in the commutator-fed secondary, because the rotating field therein is stationary with respect to the secondary turns. Consequently, the impedance of the secondary would be reduced to its ohmic resistance, and this would remain approximately true at the ordinary working speeds and small slips of the induction motor.

M. Maurice Leblanc, in a recent number of *L'Eclairage Electrique*, and also M. Bunet, in a recent number of *L'Industrie Electrique* (see Digest), have independently pointed out a fallacy in this line of reasoning. They show that if a polyphase-current-excited field rotating about a ring be apparently arrested in space by supplying the polyphase currents through a commutator, and rotating the brushes on the commutator in the opposite direction to the motion of the field; then although the field appears to be stationary in space, and seems to be stationary inside the turns of the ring, yet it is really moving to and fro by little leaps as the brushes pass the successive segments on the commutator. During each pause on a commutator segment the field is moving forward through the loops on the ring and producing c. e. m. f., while in the sudden leap back at change of commutator bar, the field is not bodily caused to retreat, but only altered in the points of its poles, so that there is no reversal of c. e. m. f. The more numerous the commutator bars, the smaller will be each advance and leap back, but, on the other hand, the more rapid will be their succession. Even with an indefinitely great number of commutator bars, the field in the ring, although apparently stationary in space, would actually be cutting turns all the time, and producing c. e. m. f. of self-induction. Consequently, the self-induction of a ring winding is essentially the same whether it be supplied through a commutator with moving brushes, or whether it be supplied through the commutator with brushes fixed and the ring moving, or whether it be fed through collected rings without the interposition of the commutator.

In other words, a rotating magnetic field established by polyphase currents in a ring winding apparently must be accompanied by self-induction or c. e. m. f. due to the advance of the field through the ring winding, whether the poles be allowed to advance around the ring, or be artificially restricted to nearly fixed lines in space by the use of the commutator. It would seem that the fallacy thus elucidated impugns the success of the Heyland unit-power-factor motor, although the object sought is so desirable that we could well afford to smile at any defect in theoretical reasoning which enabled it to be practically realized.

New York Electrical Society.

The 218th meeting of the society will be held at the College of the City of New York, corner Lexington Avenue and Twenty-third Street, Tuesday, Nov. 26, at 8 P. M. Mr. Robert Lozier will present a paper on "The Electrical Operation of Modern Tools and Machinery." This paper will be profusely illustrated with lantern slides indicative of the remarkable manner in which the electric motor has been adopted for driving purposes in practically every branch of industry and manufacture. The following well-known members of the society and others engaged in the motor field have been invited to participate in the discussion: Professor F. B. Crocker, Gano S. Dunn, C. O. Mailloux, H. B. Coho, S. L. Nicholson, C. S. Jackson, Campbell Scott, E. H. Mullin, E. R. Knowles and Robert Lundell.

Interurban Trolleys.

Interurban trolleys is the theme of an interesting pamphlet by Mr. Guy Morrison Walker, recently issued in Boston. It says that in the evolution of American transportation we have reached the era of interurban electric lines which should lead investors to investigate the intrinsic value of those lines now in operation. Interurban railways are not so heavily capitalized as are the steam lines with which they compete, the average capitalization of steam railways in the United States in 1900 being $61,490 per mile, while that of electric lines is not over $35,000. In comparing earnings it should be remembered that those of interurban lines are derived almost wholly from passenger traffic. Again, they depend on a short haul; long haul is still undeveloped. In spite of this, average earnings of steam roads from passenger traffic in 1900 were $1,674 per mile, while that of interurban lines was $3,800 per mile. With the development of interurban roads into great systems there will come a large development of through traffic that will make their operations doubly remunerative. It is well known that steam roads have not found passenger traffic profitable. Yet the very traffic they find most unprofitable—short haul—the interurban lines find highly profitable at a low fare.

Electrical Engineers of the Day—XXI.

NORMAN W. STORER.

Norman Wilson Storer was born in 1868 in Orangeville, a little village in the northeastern part of the State of Ohio, on the Western Reserve. Mr. Storer has always been a hard worker, and his early life was by no means an easy one. The death of his father when he was scarcely three years old, left his mother with five children to care for, and but a small amount of property with which to do it. Indomitable energy on her part, however, overcame lack of fortune and she managed to give her children more than an average education. Mr. Storer also did much for himself in that line, and with the help given him by his mother, worked his way through college, taking the degree of Mechanical Engineer in Electrical Engineering at the Ohio State University in 1891. He was one of the first two who obtained that degree after the starting of the electrical engineering course in that university.

Shortly after graduation he entered the employ of the Westinghouse Electric & Manufacturing Company, and has been associated with them ever since then. He soon worked his way to the testing room, where his originality and persistence quickly brought him to the front, and he was given charge of important experimental work. Having received an offer from his employers to enter the designing department, in the spring of 1893, he first took up his work in that line as assistant to Mr. B. G. Lamme, then as now chief designer of the Westinghouse Electric & Manufacturing Company.

From the beginning, Mr. Storer devoted himself particularly to direct-current design. It is generally conceded by those who are familiar with both systems that alternate-current apparatus is much simpler than that of the direct-current type. As to whether or not it is easier to design alternating-current than direct-current apparatus, is a question that perhaps but few men can answer, for the simple reason that but few men have ever actually designed commercial apparatus of both types. The commutator presents difficulties in large and sometimes even in small direct-current generators of a kind that are not encountered in alternating-current design, and for this reason it has been referred to by one of our most noted electricians as an "excrescence" on an alternating-current generator. The direct current, however, is a necessity in many industries where the alternating current can never be used, and for that reason we may always expect direct-current apparatus to be in demand. Among the many engineers who have undertaken the design of direct-current apparatus, a small number have achieved marked success. One of the most noteworthy examples of the latter class—if we may judge by results—is the subject of this sketch.

Mr. Storer's first work as a designer was in developing a line of small multipolar generators and motors which were brought out in 1894, and which are still the standard of the Westinghouse Company. The fact that this line comprises between 250 and 300 machines, may give some idea of the work involved. His next work was on engine-type generators of all sizes, and in the line which was brought out some months later were embodied all the valuable features of the small belted machines, together with the new points which continual study had shown to be desirable. The result was a line of generators which for general all-around excellence remains unsurpassed.

In later years Mr. Storer's work has broadened out and he has designed machines for all classes of service, including those for lighting, power, railway generators and motors, electrolytic generators, as well as small motors for automobile work. Some examples

of the larger machines of his design may be found in the power stations of the South Side Elevated, of Chicago; the St. Louis Rapid Transit Co., and the Boston Elevated, including 650-kw, 800-kw, 1500-kw, 2250-kw, and 2700-kw engine-type railway generators. In electrolytic work the direct-coupled units at the Piitsburg Reduction Co. at Niagara Falls, ranging in size from 560 kilowatts to 1000 kilowatts; the 600-kw generators at Raritan Copper Co., Perth Amboy, N. J.; the 850-kw generators at the North American Chemical Company, Bay City, Mich., and the 810-kw generators at the Boston & Montana C. C. & S. M. Company, Great Falls, Mont., may be seen in daily operation, and are fair samples of the class they represent. Mr. Storer is largely responsible for the design of the present line of Westinghouse railway motors, and to him is also due the credit for the present method of rating motors of this class, which has been adopted by the above company, and which will undoubtedly come into general use as it becomes better known.

Among the patents taken out by Mr. Storer, the most noteworthy is on the method of building laminated poles so as to prevent distortion of the field, thereby insuring good commutation over a very wide range of load. That his reputation as a careful designer and conscientious worker is widely recognized is attested by flattering offers he has received from other companies, both at home and abroad.

Personally Mr. Storer is a pleasant man to meet. His character is above reproach, and his quiet modesty gives one an immediate and lasting confidence in his ability to do whatever he undertakes. Mr. Storer is a member of the American Institute of Electrical Engineers and of several other professional bodies.

The Debt of Electrical Engineering to C. E. L. Brown—II.

BY B. A. BEHREND.

LOW-TENSION DIRECT-CURRENT GENERATORS.

THE Swiss Metallurgical Company in Neuhaussen had taken up the process of Heroult for the manufacture of aluminum and of aluminum alloys, and they required dynamos for large currents and low tension. They required about 12 or 15 volts and 12,000 to 13,000 amperes. The Oerlikon Works undertook to supply these dynamos, which a contemporary engineering paper called "gigantic," and Mr. Brown designed them with his hole armature for 6000 amperes, 16 to 20 volts, six poles, at 180 revolutions. Generators of such great current capacity had never been built before, and the tests that were made on July 30, 1888, showed that the dynamos could yield as much as 12,500 amperes each without injurious sparking. We give an illustration of one of these machines in Fig. 5.

An extremely remarkable feature of these machines was the use of cross connectors. It may surprise contemporary engineers that Mr. Brown used cross connectors 13 years ago on his multipolar dynamos. These cross connectors in the six-pole generators illustrated by Fig. 5 were made in the form of rings, with three lugs seated in grooves in the commutator bars.

It was in 1889 that Brown designed the first vertical shaft generator for the Aluminum Works at Neuhausen. This machine was to deliver 12,000 amperes at 36 volts at a speed of 180 revolutions. Mr. Brown made this machine with 24 poles, using in the first construction a tunnel-wound drum armature. This machine was afterwards altered for 6700 amperes and 60 volts, the armature being changed to a smooth-core drum. This machine has run satisfactorily to this very day.

A few words about the winding of the first machine may not be amiss here. It was a triple series parallel drum, doubtless the first machine made with this kind of winding which was later on claimed by other as a new invention.

The smooth-core winding had cross connectors consisting of V-shaped pieces of copper strips well-known to those who have seen the later machines built by the Oerlikon Company.

The work in low-voltage, large-current machines made Mr. Brown take up the design of a unipolar machine, of which we have

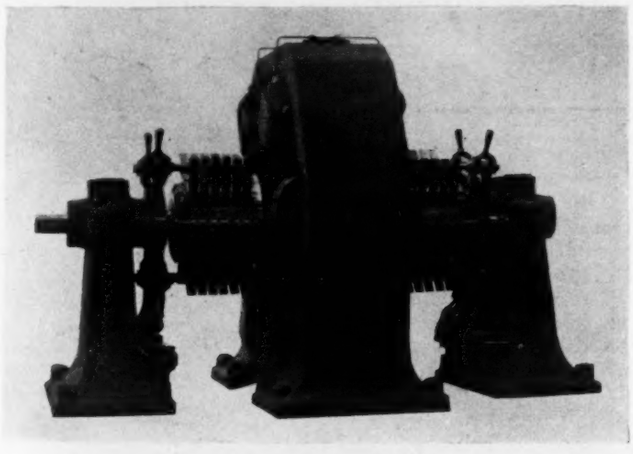


FIG. 5.—ONE OF THE LOW-POTENTIAL GENERATORS FOR THE SWISS METALLURGICAL COMPANY IN NEUHAUSEN.

no picture, however. This machine gave 200 amperes and 10 volts. During its tests, in trying to make the machine run faster, Mr. Sidney Brown, a brother of Mr. C. E. L. Brown, and about a year his junior, suffered a severe fracture of the leg by a pulley that flew to pieces. Mr. Sidney Brown is the head of the draughting department of Brown, Boveri & Co.

In connection with Mr. Brown's work in direct-current machinery we wish to give a few views of some machines of later design built at his own works in Baden. Fig. 7 represents a high-tension direct-current series dynamo, in form, outline and general design almost identical with his first machines of the same type. There was little to be changed in these first machines of which many are still in safe operation. Their commutators sometimes have almost fantastic shapes, the brushes deeply worn into them, yet they keep running sparklessly while receiving hardly any attention. An engineer of high standing once remarked of the Brush arc-light dynamo that it was so well designed at the outset that improvement has scarcely been made on it in the past 20 years, and the same might justly be said of Brown's Manchester type for high-tension work. These ma-

FIG. 6.—SIDNEY BROWN.

chines are admirable, they stand the roughest treatment, they never "buck" or flash over, they may be safely run at 2000 or even 3000 volts, and were it not for the fact that each motor required a generator of its own, these machines would hardly have had to make place to the polyphase system, which won the field because of its greater flexibility in the distribution of energy to several motors.

RECENT WORK IN DIRECT-CURRENT MACHINERY.

Though not following chronological order, we wish to describe in connection with Mr. Brown's early work in direct-current power transmission some of his later original constructions in the application of direct currents to electric traction. And here our attention is held by the Heilmann locomotive, the electrical equipment of which was designed and constructed by Mr. Brown. The "Société Anonyme de Traction Electrique, Systeme J. J. Heilmann," having to solve some difficult engineering problems, applied to Mr. Brown who worked out the driving mechanism and the many other novel constructive details that were demanded by the circumstances.[1] We present in Fig. 8 a detailed drawing of one of the 125-hp motors which are direct connected to the driving wheels, a construction that has been adopted more lately for some heavy electric hauling locomotives in this country. We are here not concerned with the relative

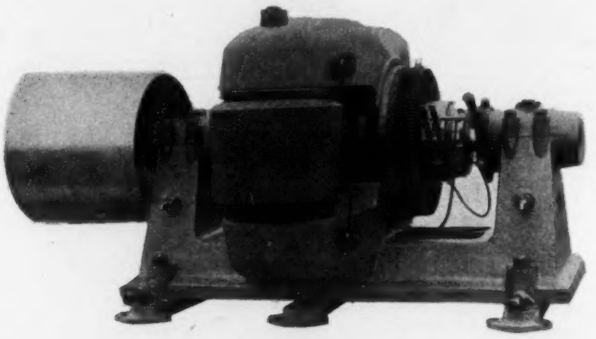


FIG. 7.—HIGH-TENSION MANCHESTER TYPE.

merits or demerits of the Heilmann system, it is the motor equipment especially that we wish to describe and to discuss, as there are some interesting features about it which have since become part and parcel of the modern dynamo.

The first Heilmann locomotive was built in 1892. Experiments with induction motors, though their results had not been unsatisfac-

[1] Mr. Brown writes to the author on this head: "With regard to the driving arrangement I would say that its design was developed rather by the Heilmann office, and especially by their engineer, Mr. Amsler, who is now with us in charge of our continuous current designing department. Of course we in Baden also assisted in designing this gearing and, as is often the case, it is extremely difficult to say how much of the design is due to the different parties individually!

tory, had shown the superiority of the direct-current motor for this particular problem, and consequently the latter was adopted for the earlier and later Heilmann locomotives.

The armature punchings of the motor are mounted on a hollow shaft, which engages by means of a driving arm direct with the driving wheels of the locomotive, a most simple and effective construction. The armature winding is a double layer winding, each slot containing two bars, one on top of the other. This winding, now com-

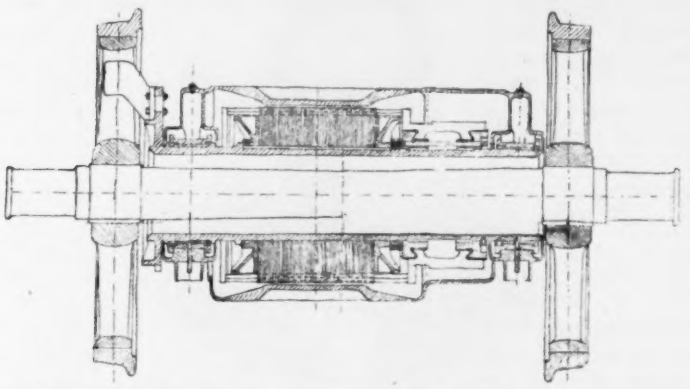


FIG. 8.—MOTOR AND DRIVING ARRANGEMENT OF HEILMANN LOCOMOTIVE.

monly called the barrel winding and in almost general use for direct-current armatures and fields—if not first *invented* by Brown—was certainly *introduced* by him. It is extremely difficult, especially in this particular case, for a younger man to know how far this important construction had been foreshadowed in the eighties. The early Siemens dynamos for electroplating purposes had bar-wound drum armatures with an arrangement of the end connectors which was afterwards applied by Eickmeyer to wire-wound armatures, while C. S. Bradley described direct-current armatures with two conductors side by side and arranged in two layers. But there is a vast stride after all from the work of the professional inventor, who—like Nature—pours forth, seemingly without particular care or discernment, the creatures of his mind to let them sink or swim in the stream of

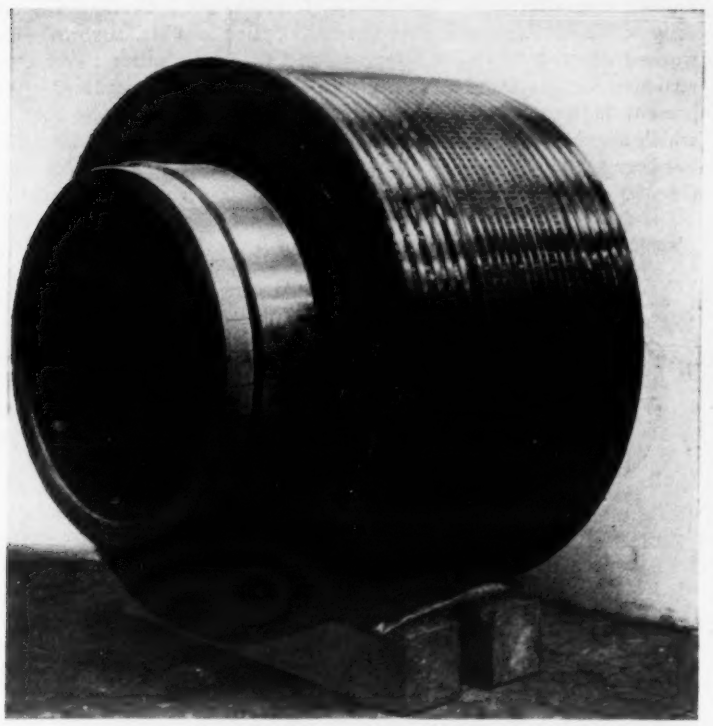


FIG. 9.—ARMATURE OF 360-KW RAILWAY GENERATOR.

new inventions, to the work of the designer full of important details which, if neglected, jeopardize the success of the whole construction. Even if there are among the rubble of inventions the constructions which able engineers have afterwards put into practical form, it hardly diminishes the merits of the designer, while, of course, it would be wrong not to acknowledge the merit of the inventor. It is certain that Mr. Brown was the first to employ the double-layer winding on a large scale, and publishing and describing his constructions with his usual liberality so rare among engineers, called attention to it in wider circles which ended in its general adoption all over the world.

RAILWAY GENERATORS.

Mr. Brown is one of the few men in Europe, if not the only one, who has not fallen behind in direct-current work, and his designs in this field are thoroughly American, which is surely the highest praise that can be conferred on direct-current machines. Figs. 9 and 10 show, respectively, the armature and the field of a 360 to 500-kw railway generator for 105 r. p. m. It is an eight-pole machine for 550 volts, the armature having 240 slots, the number of commutator bars being 480. The diameter of the armature is 1900 mm, the length of the core 460 mm. The winding is a parallel drum. The temperature rise after 10 hours' run with 360 kilowatts was only 22 degs. C. on the armature, and 25 degs. C. on the field coils. No brush shifting is necessary, in spite of the field being shunt wound. The weight of the machine with two foundation plates, but without shaft or bearings, is 45,000 lbs.

Telephony and Telegraphy in England.

The British Postmaster General has recently issued his annual report. In regard to the London metropolitan exchange system it is stated that the greater part of the underground work has been completed. About 160 miles of pipes have been laid, into which about 20 miles of cables (each containing from 200 to 434 wires) have already been drawn. In the other districts (Westminster, Kensington, etc.) about 110 miles of pipes have been laid, and about 16 miles of cable drawn in. Owing to unforeseen difficulties which have been met with in carrying out the underground work, and in obtaining and adapting buildings for the exchanges, it has not yet been practicable to bring the system into operation.

The number of telegrams sent during the year was 89,576,961, showing a decrease of .92 per cent. To cope with this vast amount of work is a staff of 173,000 persons, of whom 94,000 (including over 15,000 women) are on the regular establishment. Close upon 80,000 fill unestablished situations, and of these 20,000 are women. The total

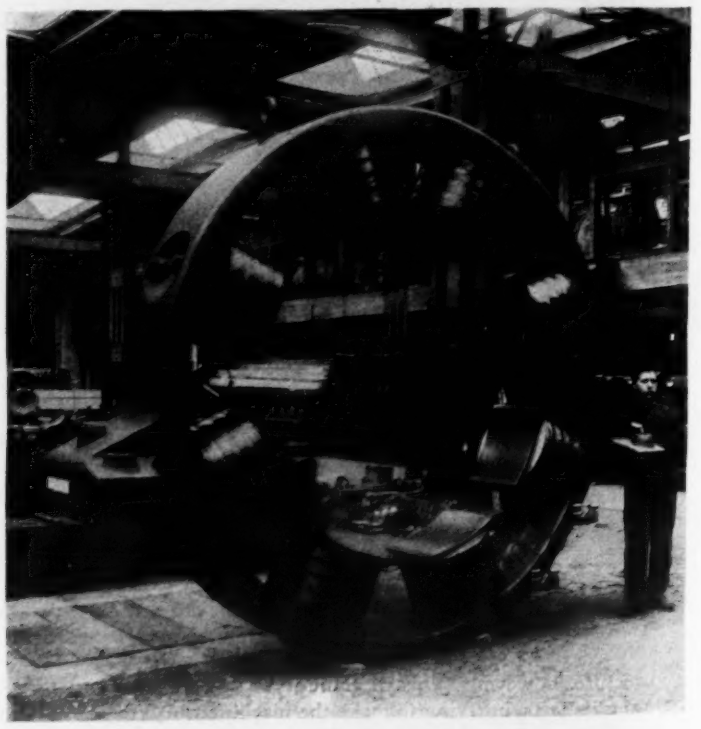


FIG. 10.—FIELD OF 360-KW RAILWAY GENERATOR.

wages of this great army amounted to nearly £9,000,000—almost exactly one-half of the total revenue of the Post Office. The net deficit on telegraphs was £353,216, or £64,624 more than last year. If allowance be made for interest on the capital—£10,868,663—created for the purchase of the telegraphs, the deficit on the year is raised to £652,104.

Surges in Transmission Circuits.

By A. E. KENNELLY.

MR. STEINMETZ'S recent and able paper, read before the American Institute of Electrical Engineers (22d August, 1901), has drawn attention to the importance of considering the limits of pressure which may be attained in a high-pressure alternating-current circuit, by reason of sudden changes in the circuit's electrical condition, as, for example, by the rupture of a short-circuit. Mr. Steinmetz gave in that paper certain approximate formulæ for determining the oscillatory rise of potential in a transmission circuit of known electrical constants, under known conditions of sudden disturbance. The paper was, however, of a markedly algebraic character, and on that account may not have received its full appreciation at the hands of those who are not mathematicians. It will be seen, however, in what follows, that the essential conclusions of Mr. Steinmetz can be attained in a very simple manner, and that the process of reasoning is well within the grasp of the majority of electrical students.

The worst condition that can arise in connection with an electrical transmission circuit from the standpoint of the engineer, that is to say, the most violent and dangerous electric surge, is that which immediately follows the sudden rupture of a short circuit. The current that the circuit carries at the time of the short circuit is probably far in excess of the maximum normal working current, and consequently the circuit under the circumstances considered is first supplied with an unduly powerful current, and then this current is suddenly interrupted. If the said current in the circuit is continuous, or non-alternating, then no matter at what particular moment the interruption takes place, the resulting surge set up in the circuit will be the same. If, however, as is usually the case in practical high-pressure circuits the current is alternating, then the magnitude of the succeeding surge will depend upon the value of the current at the instant of rupture. If the alternating-current wave happens to be interrupted just at the zero point, the resulting surge will be negligibly small. If, on the contrary, the alternating-current wave of the circuit is at its crest or maximum, then the surge due to its interruption will be the same as though a continuous current of that full magnitude had been interrupted. The surge of interruption depends then upon the nature of the circuit and upon the magnitude of the suddenly interrupted current. If an alternating-current short circuit is broken gradually, i. e., through external resistance either automatically, or by hand, there will be no appreciable surge. Similarly, if the alternating current is interrupted at or near the zero point, either automatically or by hand, there will be no appreciable surge. The pressure acting upon the circuit at the time of interruption has a distinct but subsidiary, and practically negligible, effect upon the surge of interruption, partly because the pressure is greatly reduced in the case of a short circuit, and partly because the effect on the surge of even the normal pressure, at the time of interruption, is usually far less than the effect of the abnormally great current strength.

From an electrical point of view, therefore, the worst case that can happen is the sudden interruption of a current strength of I amperes in a transmission circuit consisting of a pair of wires, the inductance of which is l henrys per loop mile or kilometer, and the capacity between which is c farads per loop mile or kilometer. The value of I in the case of sinusoidal alternating-current waves may be anything up to $\sqrt{2}$ times the effective value of the assumed steady alternating current just before breaking. That is to say, the value of I may be as high as 41 per cent in excess of the indicated amperes, if there were time to obtain a reading just before the interruption, and it might happen to be anything between this maximum value and zero. Even with non-sinusoidal currents in practical alternating-current circuits, the maximum value at the crest of the wave is not ordinarily greater than 50 per cent in excess of the indicated or effective value. We have to assume, however, that the value of I is known, and if it be due to a sudden short-circuit occurring at the receiving end of the line, we must find out in some way what the greatest possible value of I could be under working conditions. It is usually limited by the reactance of the generator armature.

If the transmission circuit is L miles or kilometers in length, and all of this length carries the current I at the moment before interruption, then the circuit will contain a certain amount of electrical energy expressed as $\frac{LlI^2}{2}$ joules or watt-seconds; or, if $L^1 = Ll$ be the total inductance of the loop circuit, the energy of the circuit at interruption will be $\frac{L^1 I^2}{2}$ joules. This energy resides in the magnetic flux surrounding the wires and linked with the circuit. This is the energy whose sudden release is capable of doing damage to the circuit by breaking down the insulators or insulation. It evidently amounts to $\frac{l I^2}{2}$ joules per mile or kilometer, and thus increases as the square of the interrupted current strength. As the interrupted current strength doubles, the energy released and capable of doing damage increases four-fold.

For example: A pair of single-phase copper wires, No. 5, B. & S. gauge, supported on poles, at an inter-axial distance of 3 ft., would have an inductance of approximately 4 milli-henrys per mile of loop. If these wires carried a current of 1000 amperes, then the electromagnetic energy per mile would be $\frac{1000 \times 1000 \times 0.004}{2} = 2000$ joules, or about 1500 ft.-lbs. This is the magnetic energy in the external medium associated with the current. If that current is interrupted gradually, as, for example, by providing a resistance coil to its discharge, this energy will be expended as heat by the discharging current through the said coil. If, however, the two lines while connected by the short circuit at the distant end, are instantaneously disconnected at the generator end, this energy is not allowed to discharge. Nevertheless, the current cannot persist after the circuit has been broken, and the energy is automatically converted by a surge in the circuit from the magnetic to the electrostatic form. The condenser formed by the two wires considered as plates separated by the surrounding insulator, becomes charged, until the electrostatic energy in the dielectric is equal to the immediately preceding stock of electromagnetic energy. If there were no resistance in the conductors, and no leakage between them, i. e., if perfect conduction and insulation existed, the energy would continue to oscillate perpetually in alternate surges between the electromagnetic and electrostatic forms, the surging current crests being intermediate in time between the crests of potential difference in the circuit. In the very first actual current surge, however, i. e., during the decay of the interrupted current, and the transfer from the magnetic to the static type, there is a loss of energy by I^2R in the actual resistance of the wires, and consequently the electrostatic energy is not quite as great as the initial stock of magnetic energy. For the same reason the successive surgings grow less and less, until, under practical conditions, they become negligibly small in, say, a dozen swings, assuming that the insulation has not been destroyed.

The electrostatic capacity of the condenser formed by the two wires is $Lc = C$ farads, where C is the total capacity and c the capacity per mile or kilometer, and the electrostatic energy of this condenser charged to an e. m. f. of E volts is $\frac{LcE^2}{2}$ or $\frac{CE^2}{2}$ joules. Consequently, ignoring the deadening influence of resistance in the first half swing, we may equate the electrostatic energy and the original magnetic energy by the expression

$$\frac{LcE^2}{2} = \frac{LlI^2}{2} \text{ joules}$$

or simplifying, $$E = I\sqrt{\frac{l}{c}} \text{ volts.}$$

This indicates the maximum value of the e. m. f., which will be attained in the first surge by the exchange from magnetic to static energy. It is clearly independent of the length of the line (to a first approximation), and depends upon the ratio of inductance to resistance, for a given strength of interrupted current. If the capacity is small and the inductance large, the quantity $\sqrt{\frac{l}{c}}$ will be large, and the surging e. m. f. correspondingly magnified. This is just the condition met with in overhead wires. On the contrary, if the inductance is small and the capacity large, the quantity $\sqrt{\frac{l}{c}}$ will be correspondingly lowered, and likewise the e. m. f. of surge, for a

given interrupted current strength. This is practically the condition of affairs in underground wires. Consequently, it fortunately happens, that just where a surge e. m. f. can do the most expensive damage, namely, in underground wires, the tendency to surge is less violent than in overhead wires, where the damage is more readily traced, and less expensive to repair. Since E is the instantaneous maximum surge voltage, and I the instantaneous current of rupture in amperes, the quantity $\sqrt{\frac{l}{c}}$ is a resistance, expressible in ohms. It may be called the *free surge resistance* or *free oscillation resistance* of the circuit. In the case of overhead wires, this free oscillation resistance varies between 400 ohms, with large wires close together, and 900 ohms, with small wires far apart. We may take the mean as 600 ohms. For underground wires the electrical conditions vary more widely, but 40 ohms may be regarded as a common value of the free oscillation resistance. Consequently, we may say that in the case of overhead wires the first surge of e. m. f. will be about 600 volts per ampere, and in underground wires 40 volts per ampere, of *suddenly* interrupted current. Interruption through an ordinary arc at a switch will not usually be sufficiently sudden to produce the full e. m. f. Interruption through a magnetically blown-out arc, or through an oil-extinguished arc, may be almost instantaneous. It seems, however, that the ordinary arc in air sometimes acts automatically like a Wehnelt interrupter, and so may interrupt very suddenly.

If the overhead line is connected with a condenser, this condenser will share the electrostatic stress and energy of surge, and consequently will tend to reduce the e. m. f. of surge. In other words, the same amount of electrostatic energy will then be stored away in both the line and the condenser, by the automatic development of a more moderate surge e. m. f.

If the short circuit, which, as we have seen, is the most dangerous cause of surge, does not take place at the distant end of the line, but say near to the generator, then although there will be less resistance in the line circuit, and this might tend to increase the current, yet if the current is limited by generator reactance to about the same value in either case, the surge e. m. f. will be less than when the whole length of line is involved, because only a portion of the line carries the excessive current, and supplies electromagnetic energy, whereas all the line will be brought into action in absorbing electrostatic energy. The line beyond the short circuit will act, in fact, like an auxiliary condenser. Cases may arise, however, when synchronous motors beyond the short circuit will act temporarily as generators, and will cause powerful currents, through the short circuit, to be sent from both ends of the line, in which case the surge e. m. f. might be as great as when the short circuit is at the distant end.

If the short circuit acts through transformers at either end of the line, the inductance of the line will be virtually increased, owing to the magnetic leakage in the transformers, and the inductance of the circuit in the calculation should be increased by the additional stray field inductance of the transformer coil or coils included in the short circuit. Although high-tension transformers have some capacity, yet they have also considerable reactance, and they tend to increase rather than to diminish the surge e. m. f.

The surge produced by the sudden application of a generator to the transmitting end of a circuit is comparatively small, and its value cannot exceed the maximum cyclic pressure. The sum total of generator and surge pressure, when throwing the generator into the line circuit, cannot therefore exceed twice the maximum cyclic generator pressure.

A surge is sometimes produced when connecting a transformer into circuit, which is due to an entirely different cause, namely, to a large residual magnetic flux in the core.

The frequency of free surge in a circuit is such that neglecting the influence of terminal transformers the inductance reactance $Ll\,\omega$ or $L^1\,\omega$ is equal and opposite to the capacity inductance $\frac{1}{Lc\,\omega}$ or $\frac{1}{C\omega}$ so that the pulsation $\omega = \frac{1}{L\sqrt{cl}}$ radians per second. But the quantity $\frac{1}{\sqrt{cl}}$ is the velocity v, expressed in miles or kilometers per second (according to the linear units in which l and c are expressed) with which the electromagnetic waves run through the dielectric, and which in air is the air-velocity of light. Consequently $\omega = \frac{v}{L}$ radians per second.

For aerial wires $\omega = \frac{300{,}000}{L}$ radians per second, when the length L of the loop is expressed in kilometers, and $\omega = \frac{186{,}380}{L}$ radians per second, when the length L is expressed in miles. Consequently, the number of radians per second in the pulsation frequency $\omega = 2\pi N$, of the surges, is numerically equal to the number of journeys that electromagnetic waves can make in running to and fro along the loop in a second. In a loop of aerial wires one mile long light could travel to and fro 186,380 times in a second, and this would be the number of radians of the frequency in angular measure, or expressed in cycles $N = \frac{186{,}380}{2\pi} = 29{,}650$ cycles per second.

We have assumed in the above statement that the only inductance and capacity of the circuit resided in the dielectric of air surrounding the two conductors. If transformer coils at the two ends enter consideration, their additional inductance and capacity will load the circuit and reduce its frequency. Even if there are no terminal inductances or capacities to load the circuit, there is always some slight extra inductance due to the magnetic flux inside the substance of the conductors themselves, which, therefore, tends to reduce the frequency somewhat below the theoretical light frequency. For practical purposes, however, we may say that the limiting frequency of free surge oscillations in a circuit is $\frac{30{,}000}{L}$ cycles per second, when L is expressed in miles. Terminal apparatus electrically tied to the line will always reduce this frequency.

In the case of underground wires employing solid dielectrics the speed of wave propagation $v = \frac{1}{\sqrt{cl}}$ is reduced by reason of the greater specific inductive capacity of the dielectric, and is inversely proportional to its square root. The electromagnetic wave speed v will be usually reduced somewhat below 100,000 miles per second, and is approximately $\frac{186{,}380}{\sqrt{\kappa}}$ where κ is the specific inductive capacity of the dielectric substance. The limiting frequency of free surge of the circuit will be usually in the neighborhood of $\frac{15{,}000}{L}$ cycles per second, or half the frequency of free aerial circuits, neglecting the retarding influences of electrically linked terminal apparatus. A 10-mile length of double-conductor cable would, therefore, have a free surge frequency of about 1500 cycles per second. It is evident that the free surge frequency depends only on the length of line, and upon the nature of the dielectric, and neither upon the frequency of the working alternating current employed on the line, nor on the cross sectional dimensions of the conductors. In regard to the influence of circuit length, the law of the frequency is the same as that of sonorous vibrating strings—it is inversely as the length.

The surges in electrical circuits here considered, and which may be of serious magnitude when a powerful current is suddenly interrupted, must necessarily take place to some extent whenever an electrical disturbance takes place in the circuit. Thus in the case of electrical transmission circuits, every change in the load or in the speed of the generator, must set up some electrical disturbance and corresponding set of surges, the intensity of which will depend upon the magnitude and suddenness of the disturbance.

These surges are sometimes popularly attributed, but incorrectly, to resonance. They are no more due to resonance than is the vibration of a suddenly plucked tuning fork. They are free oscillations due to a disturbance of the electromagnetic or electrostatic energy in the dielectric surrounding the conductors. Each disturbance produces a series of alternate current and potential waves, having the natural frequency of the circuit, until the energy of the disturbance has been entirely absorbed by the Joulean effect of the current waves.

The same surges in short insulated conductors are employed for wireless telegraphy. In this case the frequency is so high that a large part of the energy of surge is emitted in the form of the radiant energy desired, and only a portion is wasted in the conductor as heat.

The stationary waves of pressure and current in long transmission lines, under the influence of an impressed e. m. f., are due to forced oscillations depending on the frequency of the generator, and not necessarily possessing the free period of the circuit. These are properly attributable to the resonance of the circuit.

A comparison between free and forced oscillations may conveniently be made as follows: In a circuit containing inductance L^1

and capacity C, and represented in its simplest form by a series connection of inductance coil and condenser, the free frequency of oscillation of the system is such as makes the capacity and inductance reactances equal and opposite so that $\omega = \frac{1}{\sqrt{CL^1}}$ radians per second. This will make the total reactance of the circuit zero, and this will be the natural frequency of the circuit in radians per second, except in so far as the resistance of the circuit will slightly diminish the frequency. If a sinusoidal e. m. f. be impressed upon this circuit with variable frequency, resonance will occur at this, and only at this, natural frequency.

In a transmission circuit having distributed total inductance L^1 with total capacity C, and suddenly distributed as by the interruption of a powerful current, the pulsation frequency of oscillation is approximately $\omega = \frac{1}{\sqrt{L^1 C}}$ radians per second, as above pointed out. This will make the total reactance of the circuit zero. These free natural oscillations or surges rapidly dwindle and expire. When a powerful short circuit is suddenly interrupted, these surge e. m. f.'s may be many times greater than the working e. m. f. of the circuit. Their magnitude does not depend upon the length of the circuit, to a first approximation.

If the same transmission circuit of distributed inductance and capacity be subjected to the impressed e. m. f. of any pulsation frequency ω, stationary waves will be established in the circuit of such length that in the πth part of them the total reactance is zero. These stationary waves of potential and current occurring along the line are due to resonance, or partial resonance, excited by the impressed frequency upon the distributed capacity and inductance of the circuit. As the frequency varies so will the positions, wave lengths and magnitudes of the stationary waves, or stationary forced oscillations, which remain constant so long as the impressed frequency and the terminal conditions remain constant. The resonant rise of potential and current increases towards the receiving end of the line, and when the wave form of generator e. m. f. is nearly sinusoidal, the magnitude of these resonant stationary waves is usually small in commercial transmission circuits. They depend upon the length of the circuit and tend to increase in magnitude with the length.

Measurement of the Angle of Lag of Three-Phase Circuits with One Wattmeter

BY A. S. MCALLISTER.

THE last few months have witnessed an unusual development in instruments for the measurement and indication of the angle of lag or of the power factor of alternating-current circuits, and the time appears to be fast approaching when a power factor indicator will be considered as essential to a transmission circuit equipment as the inevitable voltmeter.

Where such instruments are not at present available recourse must yet be had to the measuring instruments on hand. In most cases the determining of the angle of lag involves the measuring of the real and of the apparent power.

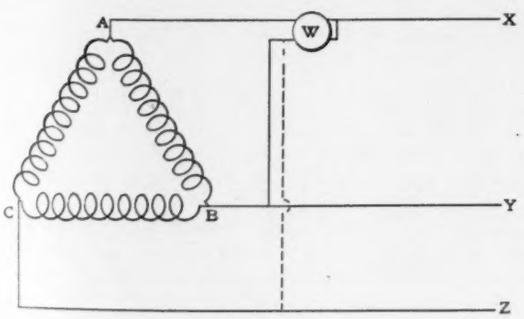


DIAGRAM OF CONNECTIONS.

In addition to the large number of instruments required for three-phase circuits by the amperes-volts-watts method of determining the lag angle the method is subject to several sources of errors. An error in the reading of a single instrument affects at once the results obtained, and though two wattmeters can in any case be so placed as to indicate the true power, yet unless the current be measured in each lead wire when the circuits are unsymmetrically loaded, the apparent watts may not be indicated by the product of amperes and volts. In fact, it is quite possible with three-phase circuits on unbalanced loads to obtain an indicated power factor greater than unity when this precaution is neglected.

A single wattmeter method which may be used for determining the angle of lag is outlined below. Though embodying nothing new in principle, it is believed that this method is not as generally well known as its simplicity and comparative freedom from errors justify.

If a wattmeter, connected as indicated by the diagram with its current coil in one lead of a three-phase circuit, be read with its e. m. f. coil across between this lead and first one and then the other of the remaining two leads, the two values thus obtained may be used to determine the angle of lag of the current by means of the following relation:

$$\tan \phi = \sqrt{3}\ \frac{W_1 - W_2}{W_1 + W_2}$$

where ϕ is the angle of lag and W_1, W_2 are two readings of the wattmeter, as indicated above.

When ϕ is greater than 60 degs. one reading will be negative, so that the difference of readings will be greater than their sum.

The proof of this relation is as follows:

Let I = current in lead $A\,X$,

E = e. m. f. of $A\,B$ and of $A\,C$,

then

$$W_1 = I\,E\cos(\phi - 30)$$
$$W_2 = I\,E\cos(\phi + 30)$$

and since

$$\cos(a \pm \beta) = \cos a \cos\beta \mp \sin a \sin\beta$$

$$W_1 - W_2 = I\,E\,[\cos(\phi - 30) - \cos(\phi + 30)]$$
$$= 2\,I\,E \sin 30 \sin\phi = I\,E \sin\phi$$

and

$$W_1 + W_2 = I\,E\,[\cos(\phi - 30^\circ) + \cos(\phi + 30)]$$
$$= 2\,I\,E \cos 30^\circ \cos\phi = \sqrt{3}\,I\,E\cos\phi$$

hence

$$\frac{W_1 - W_2}{W_1 + W_2} = \frac{1}{\sqrt{3}} \tan\phi \text{ as above.}$$

If the e. m. f. of $A\,B$ be not equal to the e. m. f. of $A\,C$, the reading of the wattmeter in either position may be corrected to such a value as would have been obtained had the two voltages been equal, in which case the above relation will hold true.

Since any proportional error in the calibration scale of the wattmeter affects equally both the sum and the difference of the readings, and hence does not alter the ratio of the two, it follows that a wattmeter having a proportional scale error of any value whatever may be used to obtain the correct value of lag angle, and that any instrument of the dynamometer type, whether calibrated or not, may be used in place of the wattmeter.

The lag angle thus obtained is the true angle between the current in lead $A\,X$ and the mean voltage between $A\,B$ and $A\,C$.

If the circuits are symmetrically loaded the sum of two correct wattmeter readings will equal the real power, while from the difference of the two readings may be obtained the "wattless power."

Novel Lightship.

The Diamond Shoal lightship, No. 71, Captain Tawes, has arrived in Baltimore, where she is to be installed with a new electrical apparatus, which is to send a 13-inch beam of light from the ship's deck to the clouds. The clusters of lights now at the tops of the two masts are visible 13 miles at sea, but it is expected that the pillar of light rising to the skies may be seen 30 and 40 miles at sea. This new marine signal is the device of Commander Albert Ross, inspector of the Fifth Light-House District, and will be put in operation Jan. 1. It is expected that the sky-piercing shaft of light will also be adopted at Fire Island, Sandy Hook and Nantucket Shoals lights. It is not proposed to abolish the present masthead beacons. As a guide to mariners coming in from sea, the 13-inch electric beam, reaching up in the dome of night, will, it is asserted by those responsible for the scheme, be as far ahead of big electric beacons of the first order as the beacons were ahead of the oil lamps.

Elements of Illumination—XXXIV.

By Dr. Louis Bell.

THERE is at present no conventional method of comparing the brilliancy of different sources of light. Flames are universally rated by their intensity as measured in a horizontal plane, in a direction generally 45 degs. from the plane of the flame if the flame is flat, or irrespective of direction in argand and other symmetrical round burners, including mantle burners.

In the early days of electric lighting the photometric question assumed some importance, and all sorts of wild statements were afloat as to the power of the new illuminant. Arc lamps were apparently rated at their momentary maximum intensity on the most favorable direction. The rivalry between makers of arc lamps did not tend to depreciation of their intensity, and so it came about that an open arc taking about 450 watts was rated at 2000 candle-power, while a similar arc of about 325 watts was rated at 1200 candle-power.

While it is possible that some experimenter at an especially favorable moment may have obtained these intensities in a single direction, it is certain that the ratings were very soon regarded as merely conventional. They have long since been relegated to the category of merely commercial designations, the rating bearing no more precise relation to the thing than does the term "Best," as applied to flour or other commodities.

When an individual or a municipality contracts for a 2000-cp arc light the thing bought, received and paid for, is an arc light taking about 450 watts of electrical energy, and such is the general understanding of the term as interpreted at various times by the courts. There is not nor has there ever been in commercial use in this country or elsewhere an arc lighting system using lamps actually giving anywhere near 2000 candle-power, either as maximum zonal intensity or as mean spherical intensity. The former requirement would demand about 750 watts at the arc, the latter nearly 1200. Lamps of such power have only been used for searchlights and similar purposes, and are far too powerful to be advantageously used for ordinary illumination.

In incandescent lighting the ratings are intended to express the real candle-power of the lamps. Sixteen candle-power is a figure borrowed from the legal requirements for gas, and corresponded originally to a measurement corresponding to that applied to gas flames, i. e., in a horizontal plane 45 degs. from the plane of the curve formed by the filament.

With the introduction of looped and spiralled filaments giving a better distribution of light than the simple U-shaped filament, demand arose for a method of measurement which would credit these lamps with their just due. Hence arose the measurement of mean horizontal candle-power by rotating the lamp. This credits the lamp with its just horizontal candle-power as against a lamp giving 16 candle-power only in certain horizontal direction, but it fails to give credit for gains in spherical distribution and puts a premium on lamps with long U-filaments adapted to throw out a large proportion of horizontal illumination.

Mean spherical candle-power, i. e., total luminous flux, is unquestionably the fairest basis of comparison between various sources of light, but it is somewhat troublesome to measure, and runs counter to long established custom and legal requirements as to gas lighting. It is certainly desirable that a uniform method should be established for all radiants, and this is no easy matter. There is a strong tendency to apply the mean spherical measurements to arc lamps, although the lower hemispherical candle-power is sometimes used instead on the ground that downward light is the proper criterion of useful illumination. This rating is approximately true of lamps having reflectors over them, but it is certainly not true in general, for it neglects the very great effectiveness of diffuse reflection from walls and ceiling.

The fact is that no simple rating can be applied with equal fairness to all commercial sources of light, by reason of their very great diversity in the nature of the light-distribution.

The mean spherical measurement comes nearer to general fairness than any other, and could it be universally adopted it would afford a very satisfactory basis of comparison. As a practical standard at the present time it leaves considerable to be desired.

Mean horizontal candle-power is by far the easiest thing to measure, and is to be recommended, save in the comparison of radiants deliberately planned, as in cases of intensive gas burners, the American type of Nernst lamp and certain arcs and incandescents, to give particularly strong illumination in some other direction.

The thing most to be desired in practical photometric work is a general international convention defining empirically, if need be, certain bases of work. A working reproducible standard of greater intensity and better color than the Carcel or Hefner lamp is badly needed. As actual standards for use on the photometer, bar nothing, can be better than incandescent lamps, but as has already been noted, they are not reproducible. The nearest approach to a reproducible standard of good size and color at present available seems to be the Vernon-Harcourt 10-cp pentane lamp, which is the present official standard in London. It has not yet been subjected to as searching and protracted an investigation as the Hefner lamp, but the reports so far obtained from it are highly encouraging, while its intensity and color are great advantages in passing from it to the more powerful modern radiants.

Granted a proper standard, there is also needed a definite conventional method of dealing with the color difficulty. This involves a tougher problem even than the standard itself. Possibly Crova's method or some modification of it might be made to serve a useful purpose. Finally, aside from the difficulty of comparing lights differing widely in color there remains the question of the different illuminative values of such lights when put into practical service. This again suggests the question of measuring illumination instead of the intensity of the radiant, but as has already been indicated there are no methods of measuring illumination comparable in precision with ordinary photometry, which is saying little enough.

It is to be hoped that the recently organized Bureau of Standards may facilitate the study of these puzzling matters and promote an international photometric congress that can give general sanction to a definite programme in commercial photometry.

A great deal of time and effort has been wasted in this world in the promulgation of so-called "absolute" standards, referred in a perfectly definite way to immutable constants of nature. Desirable as they are, it is of far greater importance to have a convenient reproducible and international set of units in universal use. The metric system started on its career as an absolute system, but its value lies not in the supposed relation of its units to natural constants, but in their relation to each other, and in its well-nigh universal acceptance as the basis of scientific measurements of length and mass.

Standards as concrete things may be constantly susceptible of improvement without limit. They are important practically in proportion to their general recognition at a certain conventional determinable value.

THE FUTURE OF ILLUMINATION.

At the present time the ordinary materials of illumination are pretty well understood, and their proper use is a matter of good judgment and artistic sense. Illumination is not a science with well-defined canons of what one might call illuminative engineering, but an art wherein an indefinable and uncommunicable skill pertains almost as it does in the magic of the painter.

There are certain general rules that must be followed, certain utilitarian ends to be served, but whether the result is brilliantly successful or hopelessly commonplace depends on the skill that inspires it. There must be in effective illumination a constant adaptation of means to ends, and a fine appreciation of realms that quite defies description. One may attack the problem of illuminating a great building with all the resources of electrical engineering at his command and score a garish failure, or he may conceivably be confined to the meagre bounds of lamps and candles and still triumph.

The general tendency with the modern intense radiants at command is to light too brilliantly, to key the vision to so high a pitch that it fails to appreciate the values of the *chiar-oscuro* on which the artistic result depends.

The desideratum in illumination, except for a small group of scenic effects, is the possession of cheap and powerful radiants of low intrinsic brilliancy capable of modification in delicate color tones. It is doubtful whether these qualities are compatible with very high luminous efficiency with a flame or incandescent radiant. In modern gas and electric lighting the progress toward efficiency is in the direction of very high temperature, which implies high intrinsic brilliancy.

Vacuum tube lamps at present in only a crude experimental stage give hope of better things, but at great risk of color difficulties, particularly if high efficiency is reached.

Ideally a gaseous radiant with nearly its whole luminous energy concentrated in the visible spectrum would give magnificent efficiency, but it by no means follows that it would give a good light. Sodium vapor meets the requirements just noted tolerably well, yet

there is no more ghastly light than that given by a salted spirit lamp.

It might even be possible to work with a mixture of gases such as would give a light approximately white to the eye, and yet be very far from a practicable illuminant, for the phenomena of selective absorption are such, as we have already seen, that the color of a delicately tinted fabric depends on its receiving a certain scale of colors in the light which it reflects. To the eye a much simpler color scheme is necessary to reproduce light substantially white, and such light falling on a colored fabric would by no means necessarily bring out the tints that glow by daylight.

Even the firefly's secret, could man once penetrate it, might not prove such a valuable acquisition as it would seem at first thought. To the eye it seems greenish, and, in point of fact, it so completely lacks the full red and the violet rays that its effect as an illuminant on a large scale would be most disagreeable, far worse than an early Welsbach at its most evil stage of decrepitude. We must not only steal the firefly's secret, but give him a few useful hints on the theory of color before the net result will be satisfactory from the æsthetic standpoint. Firefly light might do for a factory, but it would find but a poor market as a general illuminant.

Remarkable Automobile Records on Coney Island Boulevard.

On Saturday, Nov. 16, the Long Island Automobile Club had a large parade of automobiles through Prospect Park, Brooklyn, and then in the afternoon conducted, under the rules of the Automobile Club of America, a series of "races" on the superb Coney Island Boulevard, which stretches from the southern side of the park down to the popular seaside resort, and is one of the finest thoroughfares in the world, with a broad central road, where a dozen teams can drive abreast, two fine cycle paths, a horse path, a side driveway and two paved foot paths. It is almost level and generally straight, constituting, therefore, an ideal place for speed tests with bicycles, trotters, automobiles, etc. With the aid of the police, it is easy to reserve any portion temporarily, and on this occasion Park Commissioner Brower lent his official assistance and countenance. Not only was there a wonderful show of automobiles, but lured by the brilliant weather and their interest in the new sport, at least 25,000 Brooklynites thronged along the edges of the smooth, hard course. But for the unhandiness of the club in getting things started, the day was a great success, for records were smashed to flinders, while scarcely an automobile endured the same fate.

Temporary headquarters at the southeastern end of the course were established at Bishop's Hotel, while two or three miles away there was a reviewing stand near the northern end, so that vehicles were able to make a flying start, come to the line and then be timed over the mile which had been most carefully measured by engineers. The timing over the course was done with electricity, the work being in the hands of the Second Signal Corps, who had a station midway, so that being advised of the flying start they were ready for the arrival at the line. There a pneumatic cable lay stretched across the road so that the machine as it crossed closed a circuit and this was at once clicked to the timers at the reviewing stand, giving them just enough interval to take the time at the end of the mile. While much confusion and delay resulted owing to the frequent passage of machines not racing, each automobile actually timed was sure of its own record to a tick when the work began. The Signal Corps was also helped greatly by its temporary telephone line, and by regular wig-wagging. About 20 Signal Corps men were employed in the work, under Captain Charles Baldwin.

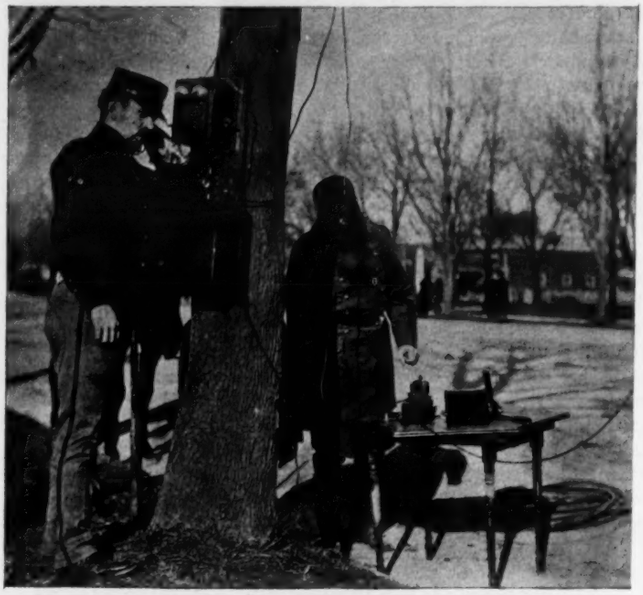


FIG. 2.—SIGNAL CORPS STATION ON THE BOULEVARD.

As already noted, all records were broken. Fournier, the famous French professional, ran his Mors 40-hp gasoline automobile over the measured mile in the wonderful time of 52 seconds on the first trial and 51 4-5 seconds on the second. Mr. Foxhall Keene, in another 40-hp Mors, did the distance in the hardly less remarkable time of 54 2-5 seconds. Mr. A. C. Bostwick, with a 40-hp Winton, did it in 56 2-5 seconds, but his machine hardly seemed to be getting the full value of regular "ignition." That the sparking devices should stand the racket at all seems surprising, for the masses of tubes and machinery hurtled through the air as if shot from a gun, and with frightful din, to which the quiet passing of Riker's electric was in striking contrast. In steam vehicles, new time was made by Mr. S. T. Davis, Jr., in a 4½-hp locomobile, which covered the distance in 1.15 seconds. A Waltham motor bicycle, ridden by Mr. R. Atkinson, was timed at 1.35 seconds, and a De Dion-Bouton motorette, under 1000 lbs., ridden by Mr. J. Longuez, got there in 1.27 3-5 seconds. In

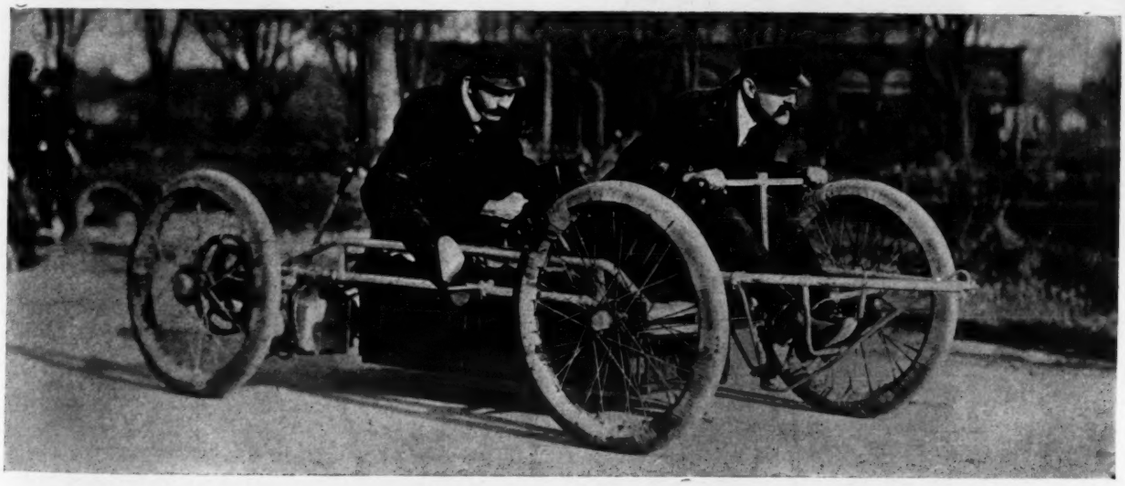


FIG. 1.—ELECTRIC RACING AUTOMOBILE.

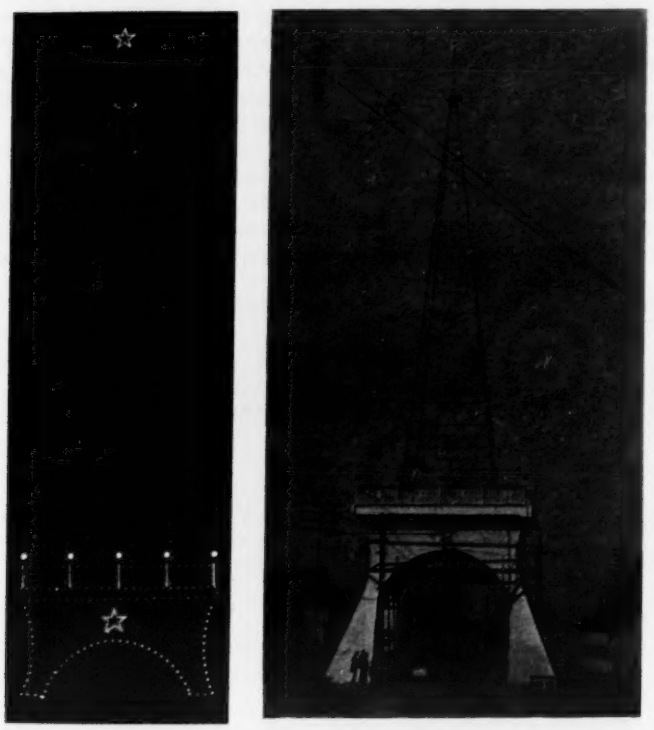
the gasolines over 1000 lbs. and below 2000, Mr. Percy Owen covered the ground in a 12-hp Winton in 1.53 2-5.

The Riker electric racer of the Electric Vehicle Company, designed and ridden by Mr. A. L. Riker, made a remarkable record, covering the distance in 1.03 seconds. It is shown herewith, although our photographer was unfortunately not able to secure a picture of Mr. Riker himself during the event. It will be seen that the machine is stripped down to the barest essentials, as in the case of the big gasoline racers. It is equipped with 60 cells, of a special type of storage battery, weighing 15 lbs. per cell, and is driven by two motors, approximately 2 horse-power each, driving the rear wheels by single reduction gear at a ratio of 5 to 1. The machine has four 32-inch wheels, with 3-inch pneumatic tires. The battery is carried between the axles on an independent frame, the frame being supported by springs attached to the reaches. The vehicle weighs complete 1850 lbs. The battery is divided into groupings of six cells each, and the controller is so arranged that it cuts in group after group, until the whole number are in series.

As a matter of fact, this machine is not intended for "road work," such as that of last Saturday, but is intended as a track racer. While the record made must be accepted, it was evident that the machine could have made better time, for Mr. Riker had to steer around sudden obstacles, which he did with wonderful nerve and dexterity, but with the certain loss of several seconds. The tests made at the works are reported to show this. The passage of the vehicle was startling not alone in its swiftness, but in its stillness, the approach being so sudden and quiet that people were not scared off the course as in the case of the racketting gasolines. This Riker machine is the one which carried off the Larz-Anderson cup last June, competing against all types of machines at the County Club, Brookline, Mass.

Illumination of Richmond, Va., Carnival Tower.

One of the features of Southern life is the indulgence in carnivals and mardi-gras festivals that are carried out with great vim and success, and with a spirit of fun that Americans, as a whole, are hardly credited with possessing. The Richmond (Va.) Carnival, held Oct.



FIGS. 1 AND 2.—RICHMOND CARNIVAL TOWER.

7-12, was a great success, the elements co-operating with superb weather. Its object was the betterment of the city, extension of business, and advertising its climate, industries and manufactures. The night pageants were very beautiful. Ten thousand electric lights were strung across Broad Street for a distance of about half a mile, making it as bright as day.

The main decorative feature was an elaborate arch constructed of wood and iron, and illustrated in the two accompanying engravings, one of which shows the decorations by day and the other by night. As will be seen, the outlines of the arch were shown by lines of incandescent lamps, while a star composed of clusters of lamps was placed at the top of the tower which surmounted the arch itself. One principal feature of electrical interest in connection with the carnival was the fact that part of the illumination of the tower was provided by electric railway headlights, which were also used to considerable extent in the city in connection with the other illuminations. The headlights on the tower are the five lights seen in the night view just above the arch, and located one on each of the pilasters. They were loaned for the occasion by F. Boykin Jacobs, Southern agent for the Syracuse changeable headlight of the Crouse-Hinds Electric Company, of Syracuse. This is the first time, so far as known, that electric railway headlights have been used for decorative purposes, and their employment offers a suggestion in other cities where illuminations form a prominent feature of a celebration.

In addition to the headlights on the arch, about 30 or 40 others were in use, adding greatly to the brilliancy of the scene; there were five in use on the arch, ten at the Carnival headquarters, four in the T. P. A. booth, four in the animal show, three in the Streets of Cairo, and others were scattered in different places in one and twos. The General Electric Company contributed the use of some apparatus for effects, and aside from private illuminations, the Virginia Development Company gave the gratuitous use of 3000 incandescent lamps, to which the Carnival Association added 10,000 more.

New Telephone Patents.

The weekly crop of telephone patents of the issue of Nov. 12 comprises a receiver detail, a silence hood to enclose only the head of the user, an inter-communicating system, a switchboard system in which the jacks themselves are switched on and off the line as required, and a two-party line toll meter. One misses temporarily the repeater and the selective signal, but the future is all before us.

To Walter F. Taylor, of Brookline, Mass., is granted a patent on a receiver embodying several minor improvements. The adjustment of the magnet in relation to the diaphragm is made by means of a supporting plate or collar attached to the magnet having a number of inclined surfaces which fit over similar inclined surfaces on an annular shoulder in the receiving shell. Rotation of the magnet will move one inclined surface over the other, causing it to be moved longitudinally. After the proper adjustment is attained the magnet is locked by screws passing through slots in the undulating collar. Other features of this receiver are semi-circular pole-pieces and an improved clamp binding post.

Canada furnishes a telephone patented by Edwin W. Smith, of St. Catherines, providing a telephone cabinet or hood, designed to take

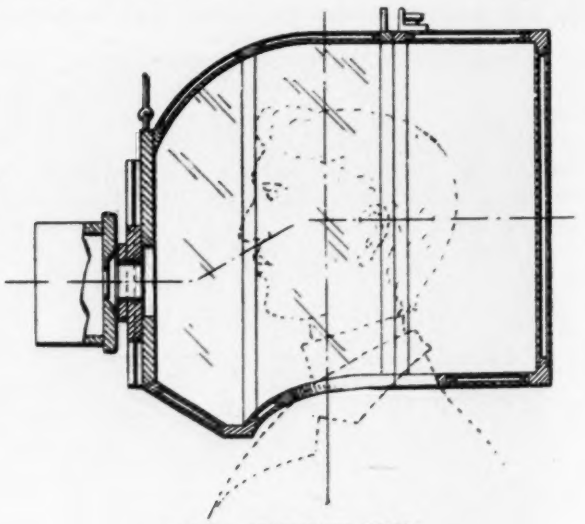
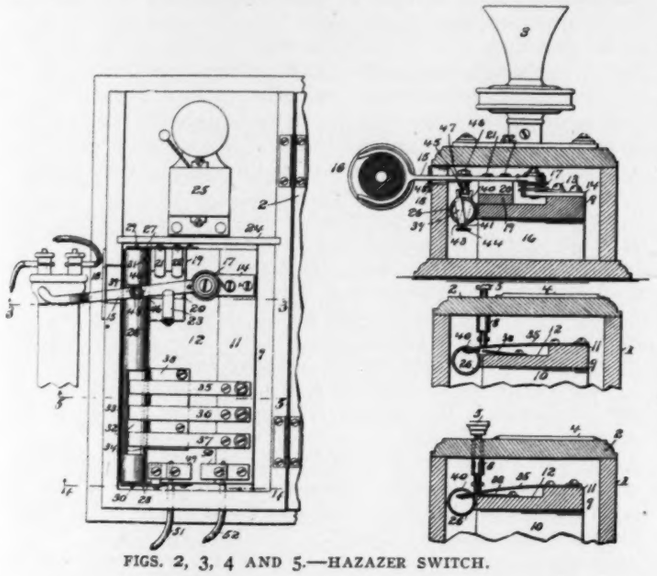


FIG. 1.—TELEPHONE HOOD.

the place of the regulation silence booth in situations where space is extremely limited. This device, which is a sort of diver's helmet of even more inelegant form than the real article, is intended to be clamped to the transmitter and to enclose what in photography are termed the "head and bust" of the telephone user. The receiver is fixed in the side of the hood, and the switch-hook consequently must be actuated by a cord and tassel, the tassel engaging in a fixed hook placed below. (Fig. 1.)

To Edgar W. Hazazer, of New York, is granted a patent on an inter-communicating system which has been ingeniously worked out and contains a clever cylindrical rocking switch that is worthy of a better cause. The place of the inter-communicating telephone system, never very solidly established, has largely been filled by the private branch exchange, which gives both interior and city service through the medium of a switchboard and a trained operator. The operation of Mr. Hazazer's switch, which is the gist of the invention, will be understood by Figs. 2, 3, 4 and 5. A metal cylinder, 26, mounted on journals so as to be capable of rotation, has a slot, 32, cut in it. Opposite the slot are springs 35, 36, 37, connected to the various lines of the system and operated by means of buttons passing through the face of the intrument case. When a spring is pressed down the end enters the slot in the cylinder which rocks forward, allowing the line spring to come in contact with a plate 38, connected to battery, and so to set a calling current flowing in the line. On releasing pressure on the line spring its end engages in the upper edge of the slot in the cylinder and so maintains the connection between the line operated and the home or calling station. When the home station receiver is replaced a cam, 45, mounted on the switch lever actuates a pin, 39, attached to the upper part of the cylinder, causing the cylinder to rotate back and release the line spring engaged in the slot. The releasing pin is pivotted at 41, and held in position by a spring 44, so that the switch-hook in passing up merely works the pin against the spring and only in passing down causes the pin to rock the cylinder.

Mr. Ernest C. Robes, of Medford, Mass., patents and assigns to the American Bell Telephone Company a service meter adapted for use in connection with two-party lines. The meter is of the push-button variety, necessitating the pushing of a button by the operator to register a call. This would be necessary in any case with party lines, as a selective meter could scarcely be hoped for, but it is found also the most practical way of operating meters for direct lines, since a purely automatic meter necessarily registers all calls whether they result in completed messages or not.



FIGS. 2, 3, 4 AND 5.—HAZAZER SWITCH.

In Mr. Robes' invention (Fig. 6) most ingenious use has been made of parallel circuits. The meters M and N for stations A and B, respectively, are in parallel with the cut-off relay R of the line L carrying the two stations; the magnet O of meter M is specially made so as to be slow acting and a controlling magnet w, quick-acting under a strong curent, serves to operate a detent 14 which engages in 15 and locks the meter movement of M when it is desired to operate N and not M. The magnets of the meters, it will be seen from the diagram, are all in circuits parallel with the circuit of the cut-off relay R, but the amount of current flowing though them under ordinary conditions is not enough to excite any of them.

The operation of the meters is as follows: One of the stations on line L has sent in a call by taking down his receiver. The line-relay R^3 responds, the operator plugs P into one of the spring jacks J, and proceeds to take the order and to establish the desired connection. As soon as the plug is inserted the local circuit W is closed and the normal current thereof excites and operates the cut-off relay R. The said current is competent to work the supervisory lamp S^2, but does not, because the main line current exciting the relay R^3 establishes the shunt around S^2. The said normal current is not strong enough to work either of the meters M or N. When, however, the connection called for is established, it becomes necessary to make a charge against the sub-station originating the call, and should the said call have been sent in by sub-station A it is to be registered by the service meter M. To effectuate such registration, the operator presses the key K, and this, making contact with point 24, closes the short circuit from point 46 through conductor 29, and around the lamp S_2, its controlling shunt and resistance r^2.

The resistance of the local circuit being thereby reduced, the current of battery F is correspondingly strengthened, and is now strong enough to fully excite the actuating-magnet O of the meter M, which accordingly registers the call against sub-station A; but the said current thus strengthened to a medium degree is still too weak to affect the magnet x of meter N, or the detent-magnet of meter M, and no registration is made, except by meter M. In case, however, the call shall have proceeded from sub-station B the operator presses the key K^2 to make the required registration or count. In this case all of that portion of the normal local circuit W that lies between said key and point 33, including the battery F, is dissevered from the portion of the circuit which includes the meters and a new connection between the latter and the more powerful generator source G is established, the old circuit being opened at the back contact 26 and the new one closed through the front contact 23.

The current from source G thus thrown on the line is strong enough to excite the actuating magnet x of meter N and the said meter is operated, registering the call against sub-station B; but the current of maximum strength sufficient for the operation of magnet x is clearly strong enough to operate magnet O also, and it is, therefore, necessary to provide means for preventing the operation of meter M when the key K^2 is manipulated to operate meter N. This is done by the detent or locking magnet w, which responds to the current of source G, and is operated simultaneously with magnet x of meter N. The locking magnet w operates much quicker than magnet O, which, as has been stated, is sluggish or slow operating, and registration by the meter M is thus prevented by the prompt movement of the armature of magnet w, which is attracted into line with the stop pin 15 of armature 16 and consequently blocks the movement of that armature. The meter M, representing sub-station A, is thus exclusively responsive to the manipulation of the key K, and the meter N in like manner is exclusively responsive to key K^2.

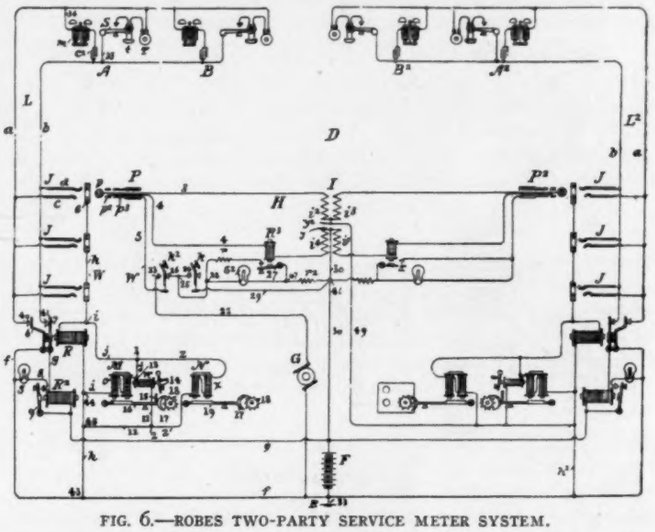
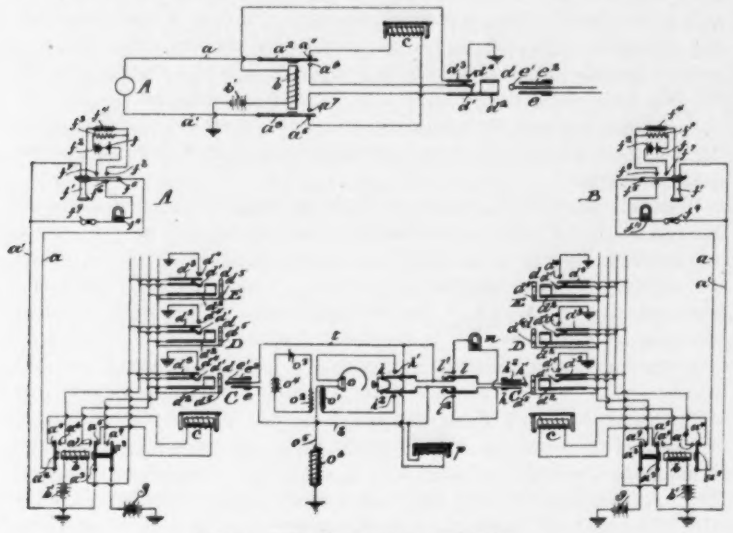


FIG. 6.—ROBES TWO-PARTY SERVICE METER SYSTEM.

Mr. F. W. Dunbar, of Chicago, patents a switchboard system in which the principal idea is that the spring jacks are normally disconnected from the line and the line signal is automatically disconnected and the spring jacks connected on the insertion of the plug in the answering jack. Mr. Dunbar claims that in many telephone systems where the line signal and answering jack are normally connected to the line it frequently happens that the insertion of a connecting plug serves to accidentally actuate the signal at a time when it should remain inert, and this fact leads to difficulty. Moreover, the arrangement limits the number of different circuits which may be employed. In Mr. Dunbar's invention, a relay energized when the plug is in-

serted in the jack disconnects the line signal and connects the jack to the line at practically the same moment. In the case of multiple



FIGS. 7 AND 8.—DUNBAR PATENT.

switchboards the whole set of jacks belonging to a line may be controlled by the same relay.

Fig. 7 shows the application of the invention to a line with a single jack, and Fig. 8 to a line with multiple jacks. It will be seen that the relay *b*, whose circuit is closed by spring d^3 making contact with d^4 when the plug is inserted, disconnects the line signal and connects the

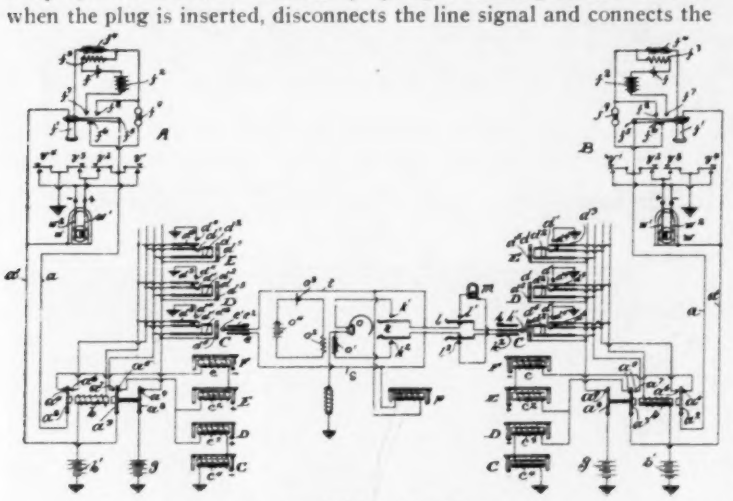
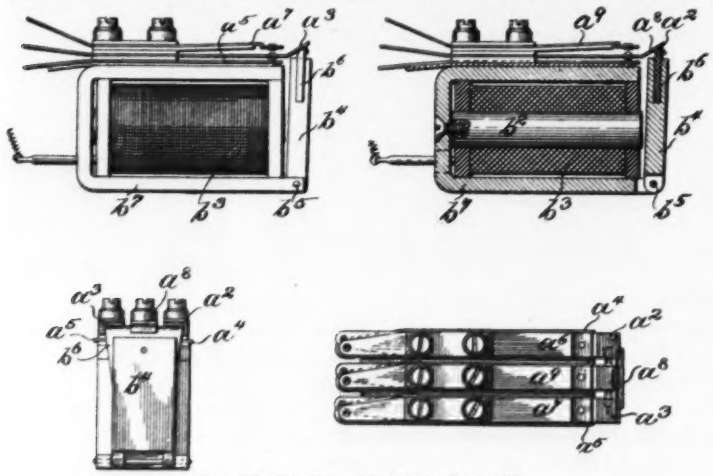


FIG. 9.—DUNBAR PATENT.

line springs of the jack to the line by opening the contacts between a^2 a^4 and a^3 a^5, and closing the contacts between a^2 a^6 and a^3 a^7. In Fig. 8 the relay *b* carries an extra spring, a^8, which closes the test circuit by making contact with a^9.

Fig. 9 shows the adaptation of the invention to the divided multiple system, which method of operating Mr. Dunbar probably had chiefly



FIGS. 10 TO 13.—DUNBAR PATENT.

in mind in working out his invention, since the difficulties which it is to cure are not of frequent occurrence in standard or ordinary multiple systems, and in the regular common battery system the cut-off relay keeps the line signal quiescent when once the connection is up. In this style of divided multiple system the subscriber signals at will any one of four portions of the switchboard, according to the location of his correspondent's switchboard line, as indicated by the directory number. Here, of course, it is of distinct advantage to have the four polarized indicators cut off as soon as the call is answered and, moreover, the arrangement of jacks normally disconnected and of signals cut-out when the jacks are in use permits, as Mr. Dunbar points out in his specifications, of using advantageous circuits that could not otherwise be employed.

Figs. 10 to 13 show the type of relay used for changing the circuit over from signal connection to line connection. Three sets of springs are used, as shown clearly in Fig. 10. The springs a^2 and a^3 normally rest on contact plates a^4 and a^5. When the armature is attracted the insulating block b^6 pushes a^2 into contact with a^6, a^3 into contact with a^7 and a^8, which has no lower contact, into contact with a^9. When the test is desired to be silent for "busy" and a click for idle a^8 and a^9 are normally in contact and break when the relay is energized.

Cost of Constructing and Operating the Port Chester Road

Few electric railway projects have excited more interest in New York and vicinity than that of the New York & Port Chester Railroad Company, which is being promoted and engineered by Mr. C. O. Mailloux and other well-known electrical engineers and capitalists. It is warmly supported in the region to be traversed, but is opposed by the New York, New Haven & Hartford Railroad, which apparently fears a loss of passenger traffic from the competition. The new road, of which details have already been given in these pages, will connect at its southern end with the new underground system of the Rapid Transit Commission. Last week a large amount of interesting and important evidence was given on the subject before the New York State Railroad Commission.

Mr. Frank J. Sprague, vice-president of the Sprague Electric Company, pronounced the plans of the New York & Port Chester Company the best he had ever seen. He declared the construction of the road along the lines proposed to be perfectly practicable. He declared that more power could be put on the electric cars than it is possible to give to the Empire State Express. The petitioners sought to show by Mr. Sprague that his company would accept a contract to electrically equip the proposed road at the figures estimated by the new corporation. Mr. Sprague said he would be glad to take the contract, and stated that the electrical equipment would cost about $2,717,500. To this he added $365,000 for cars and trucks and $190,000 for buildings and stations, making a grand total of $3,272,500. In addition he estimated that the cost of the telegraph and telephone service would be from $125,000 to $150,000. He asserted that the road could be operated for less than $600,000 per year, exclusive of the cost of the maintenance of way, structures, bridges and roadbed.

Mr. William H. Coverdale, a railroad engineer, deposed that he had made a thorough study of the company's plans, and an examination of the territory to be traversed. He believed the company could keep its promises and operate the road at a profit. He estimated that the company could count on 21,000 10-cent and 16,000 5-cent fares daily, and this would mean an annual revenue of about $1,110,000, with mail and express business of $100,000, making net earnings of $550,000. In his opinion the proposed railway could be operated at less expense than any other in this section. He figured the per capita value of every inhabitant along the route north of West Farms to be worth $11 a year to the company, and below West Farms $3.

Mr. Edwin Thacher, of New York, a civil engineer since 1863, expressed the opinion that the company's figures of the estimated cost of the road were ample.

Mr. William C. Gotshall, president of the New York & Port Chester Railroad Company, gave some interesting figures to the Commission relative to the probable earnings and operating expenses of the projected railroad. He estimated the operating expenses at $669,921.44. He placed the gross annual earnings at about $1,400,000, with net earnings of about $800,000.

Asked for details regarding how he arrived at such results, Mr. Gotshall testified as follows: "I estimate the population of Port Chester at about 7000, which should give 60 round trips each year at 15 cents, or $126,000. Harrison and Rye, with 2000 people, are expected to make trips enough to bring in $36,000. Mamaroneck and

vicinity, with 5000 inhabitants, should, according to all statistics, paying a 12-cent fare, brings us $72,000. New Rochelle and Larchmont, with 20,000 population, paying a 10-cent fare, ought to be good for 75 trips a year, netting $300,000. The interchange of traffic between New Rochelle and Port Chester at a 5-cent fare, should return $90,000; from the 28,000 people in Mount Vernon and Pelham, with a 6-cent fare, the returns should be $252,000; the interchange of traffic between New Rochelle and Mount Vernon, with a population of 35,000, paying a 5-cent fare, should return $52,500, and between Mount Vernon and Port Chester, at a 7-cent fare, $86,800; the business between the Bronx, with its population of 100,000, and New York ought to be worth $250,000 per annum, while the receipts in the summer from persons seeking recreation at resorts along the route ought to bring in $225,000, making a total of $1,490,300.

Mr. Gotshall placed the operating expenses as follows:

Train crews	$84,080.89
Station men	80,300.00
Maintenance of cars and equipment	90,000.00
Maintenance of roadway	96,000.00
Power and maintenance of stations	253,116.55
Rotary stations	16,425.00
Salaries of officers	50,000.00
Total	$669,921.44

Asked by Mr. Taft if any provision had been made for suits for damages decided against the company, Mr. Gotshall replied: "We don't intend to have any accidents."

Philippine Tariff on Electrical Goods.

On Nov. 15 the Philippine Commission's new tariff law went into effect. The section relating to the importation of electrical machinery and appliances makes the following rates: Apparatus and appliances (not machinery) for electric lighting and power: Switches, cut-outs, lamp sockets, shade holders, rosettes, plugs, brushes of copper and carbon, wet and dry batteries complete, tapes and compound for winding wires, testing sets, testing bells for current, arc lamps and fittings for same, fuse-boxes, insulating coils, and all insulating materials not elsewhere expressly provided for, $3 per 100 kilos, net weight; galvanometers, amperemeters, voltmeters, $25 per 100 kilos, net weight. Only articles used exclusively in the generation and distribution of electric currents for light or power shall come under this classification. Storage batteries for lighting or power, $25 per 100 kilos, net weight; dynamos, generators, exciters, and all other machinery for the generation of electricity for lighting or for power, also transformers, $5 per 100 kilos, net weight; incandescent lamps, electric, mounted or not, $2 per 100; porcelain, plain, in electric insulators and other similar articles, not decorated, $4 per 100 kilos, gross weight; cables, 75 cents per 100 kilos, net weight. Copper and alloys of copper in wire, galvanized or not: One mm. or more in diameter, $4.50 per 100 kilos, net weight. Less than 1 mm. in diameter, $4.50 per 100 kilos, net weight. Silvered or nickeled, 35 cents per kilo, net weight. Copper and alloys of copper in wire, covered with textiles, not elsewhere provided for, or with insulating materials, cables for conducting electricity over public thoroughfares, $5 per 100 kilos, net weight. Carbons prepared for electric lighting, $5 per kilos, gross weight. Automobiles for passengers and merchandise, $60 each.

Consolidating Western Independent Telephone Lines.

Note was made in these pages recently of the intention to use the independent telephone system of Elgin, Joliet and Aurora as a nucleus for combining independent lines in the West into one consolidation. The principal owners of the Northwestern Telephone Company, operating lines in the Fox River Valley, are among the incorporators of the Inter-State Independent Telephone & Telegraph Company, which received lately a charter in New Jersey, authorizing a capital of $3,000,000 and bonded indebtedness of $9,000,000. The purpose of this company is stated to be the unification of all independent systems in the West, and, probably, ultimately to reach into the East. The Oskaloosa (Ia.) and other independent companies are interested in the venture, and it is expected to enlist all similar concerns in the Northwest.

The board of directors and officers of the new company have not been chosen, but they will include two or three Chicago capitalists and many or all of the present board of the Northwestern Telephone Company. This board includes Senator H. H. Evans, E. J. Clapp, E. B. Conklin, A. B. Conklin and J. F. Harral, of Aurora; C. W. Devoe, of Orwell, Ohio; W. T. Campbell, Cleveland, Ohio; Charles F. Stotzer and E. H. Harison, of Wauseon, Ohio. The Northwestern Telephone Company was organized only a year ago, and it now has in service 3200 telephones. Besides having a conduit system in Joliet, Aurora and Elgin it links the Fox Valley with the Mississippi, has 634 miles of poles and 3600 miles of wire, and has service in half a hundred towns in its territory. Selon H. Case, who is interested in the new company, said last week:

"The interests that we represent have taken over the Northwestern Telephone Company, of Aurora, as well as the Whiteside-Harrison interests and the Oskaloosa Telephone Company in Iowa. We will soon have lines operating in the States of Indiana, Iowa, Ohio, Illinois and Wisconsin. There is a large gang of men working in western Illinois, and we hope to invade the cities of Springfield and Peoria, and in doing so reach the smaller towns in the vicinity of these cities. We will work as far east as Akron, Ohio, but I am not able to say whether the company will be extended farther. The intention is to put in a reasonable and satisfactory telephone service and one that will have the interests of the people at heart. There will be no party line service. The incorporators of the company have not as yet elected any officers, and this matter will come up later. The entire investment in these telephone interests up to date represnts something about $3,000,000.

CURRENT NEWS AND NOTES.

LIGHT WITHOUT SWEETNESS.—Professor Gorham, of Brown University, Providence, R. I., who is seeking to find an artificial light which is free from the element of heat, has extracted from a decayed porterhouse steak sufficient illumination to take photographs. He believes he is on the road to definite results.

BUYING PARIS RAILWAYS.—A cable dispatch from Paris of Nov. 15 says: The European edition of the *New York Herald* asserts to-day that a group of American capitalists, headed by John D. Rockefeller and others interested in traction companies, has practically secured control of the Paris Compagnie Generale de Traction, which owns a number of lines entering Paris.

FRENCH ENGINEERS' AMERICAN VISIT.—The greater part of the current issue of the *Bulletin* of the Société Internationale des Electriciens is devoted to a report of the delegates of the Société who were commissioned to attend the recent general meeting at Buffalo of the American Institute of Electrical Engineers. Professor Janet gives a general account of the visit of the French delegates and their reception by the Institute and members thereof in the different cities visited, Messrs. Steinmetz, Hering, Arnold, Mailloux and Tapley receiving particular notice in this connection. Following Prof. Janet's report are abstracts of the various papers read at Buffalo. Fifty odd pages are devoted to a description by MM. Courbier and David of the various plants and workshops visited by the delegates.

AUTOMOBILISM IN FRANCE.—It is stated that poachers and burglars are adopting the automobile as a useful implement of trade. They have been learned that acetylene lamps suddenly lighted in a dark field are very attractive to pheasants and other small game. The ruse is effected by laying out nets and then turning on the light. After an hour's time the marauders collect their quarry and escape. Robbers with an automobile drew up in front of a Neuilly residence recently during the proprietor's absence, and after loading the vehicle with a hundredweight of loot sped swiftly away. The Mayor of Gannat has issued an extraordinary decree as to speed of automobiles while traversing the town. Their speed must not be faster than that of a horse on a walk, and in the commune not faster than that of a horse on a trot. He furthermore invites the citizens to assist in stretching ropes and wires across the roads to catch chauffeurs who go too fast.

CABLE RIGHTS IN CUBA.—Secretary Root has denied the claim of the Western Union Telegraph Company that, under its concession from Spain, it possesses the exclusive right to transmit private messages between the United States and Cuba.

ELECTRIC FREIGHT LINE FOR TROY, N. Y.—The Troy Terminal Electric Railway has just been incorporated. It will be a freight business only, and will be run over the streets on which the large business houses are situated and from the Hudson River docks to the railroad yards.

NEW YORK WATER POWER.—There is a probability that the water power offered by Salmon Falls, in the town of Orwell in Oswego County, will soon be utilized. The falls are in the Salmon River, and are about half-way between Altmar and Richland. They have a height of 110 ft. Options have been secured on the rights controlling the falls and the adjacent property. The promoters expect to develop 20,000 horse-power at the falls.

ATTEMPTED ELECTRIC MURDER.—A recent cable dispatch from Paris says: The French criminal authorities are investigating an extraordinary attempt to murder the director of a factory at Mascara. He went to a telephone and picked up the receiver, when he was knocked senseless to the floor. Some one had cut the wire and switched on a 10,000-volt current from an electric lighting plant. Fortunately for the director, the current partly destroyed the telephone apparatus, so that only a portion of the current was received, otherwise the director would have been instantly killed.

PARIS UNDERGROUND ROAD.—Parisians, while they delight in their underground railway, have of late been complaining about the atmosphere in the tunnel. Their misgivings were so serious that science was called in. A thorough investigation has just been made of the air conditions. According to experts, it appears that the Metropolitan, as regards atmospheric conditions, may be ranked almost as a health resort, and that the air in the tunnels is as pure as in Paris. The atmosphere in the tunnels was found to be entirely free from carbonic acid gas and to contain, in nearly every case, the normal quantity of oxygen.

WATER POWER DEVELOPMENT IN MINNESOTA.—The Twin City Rapid Transit Company, of St. Paul-Minneapolis,, is having plans made for a water-power development at Corn Creek, on the Mississippi River, five or six miles from St. Anthony Falls. The dam contemplated at this point will render available 10,000 horse-power. It is stated that the same company is interested in surveys lately made in the St. Croix River above Taylor Falls, and about 50 miles distant from St. Paul. It is also reported that the Twin City Company will double-track its line between St. Paul and Wildwood and extend it five miles around White Bear Lake to White Bear Village. In addition, the line will be strengthened and grades cut down. It is also contemplated to replace the present four-motor, 200-hp equipments with equipments of larger power.

TROLLEYS IN ST. PETERSBURG.—The following cable dispatch from St. Petersburg, of Nov. 9, would appear to have some reference to the plans of Mr. Murray Verner, recently noted in these pages: An American company has received a franchise to construct a street railway line here, which involves building an enormous bridge over the River Neva. The whole cost of the enterprise is estimated at $50,000,000. The franchise has already received the sanction of M. Witte, the Minister of Finance. In financial circles it is believed that this will have a powerful political and economical effect on the future of Russia and the United States. M. Witte certainly is anxious to develop a connection between the two countries, and will have no hesitation in doing so even at the expense of France, though two strings to his bow will be better than one.

ELECTRIC RAILWAYS IN SAXONY.—Mr. J. F. Monaghan, United States Consul at Chemnitz, Saxony, reports as fallows: The traffic on the electric street railways of Saxony has increased about 400 per cent since 1896—taking into account the number of persons carried, the number of cars and the capacity of the motors—and 150 per cent so far as the length of the railways is concerned. The length amounts to 356.33 kilometers (221.4 miles). The number of motor cars at the disposal of all the railroads amounted at the end of 1900 to 844 without and 184 with accumulators, and 403 trail cars. There were 147,645,690 persons carried in 1900, and the number of accidents was 338. There were 23 collisions with railroad cars, 74 with ordinary wagons, and 139 with pedestrians, horseback riders and bicycles. In Chemnitz, especially, the railways are well patronized by the working classes, as it enables them to live in the suburbs. The usual fare is but 10 pfennigs (2.38 cents). The line in Chemnitz paid 52 marks ($12.37) last year for every 100 marks ($23.80) invested.

A GENERAL ELECTRIC DINNER.—Two hundred members of the testing department, etc., of the General Electric Company held their second annual banquet on Nov. 9, at the Stanwix Hall, Albany, N. Y. At least two-thirds of the States of the Union were represented at the banquet, and there were included among the diners men from England, Russia, Germany, France, Brazil, United States of Colombia, Canada, Italy, Austria, Ireland, Australia and Mexico. Those present represented at least 75 per cent of the technical schools of the United States. The Japanese quartet sang the national air of Japan and received the plaudits of every man present. Brice Morrow was the toastmaster, and General Manager Emmons and Foreman E. B. Raymond spoke on the history of the company from the time of the opening of the works in Schenectady. Messrs. C. P. Steinmetz, J. C. Schermerhorn, G. W. Redfield and F. Jones made humorous addresses, which were well received. The whole affair was under the direction of Messrs. E. L. Simpson, W. H. Hutchinson, M. A. Atuesta, F. L. Reed, R. W. Cousins, L. T. Rainey and A. B. Lawrence.

ELECTRO-COPPERING METALS.—In electro-coppering metals, such as iron, steel and zinc, the metallic deposits are apt to be in a more or less imperfect state, the surfaces being composed of a succession of small semi-spheres. To obviate this defect is the subject of a patent granted Nov. 12 to Emile Louis Dessolle, of Levallois, France. In preparing the metals for the bath it is recommended that any cavities be filled with a metallic cement consisting of a hydrate of metallic tin, which may be produced by immersing two thin plates of tin in a sulphuric acid solution and subjecting them to an electrical current. After about half an hour the plate constituting the negative pole will be covered with a gray deposit, which may be removed by the air of a scratcher, this deposit being stannus hydrate. After the cement has been applied, the metal is immersed in an alkaline bath and submitted to an electric current, whereby it receives its first copper coating. It is then placed in a bath, in which a rapid circulation of the electrolyte is maintained, the electrolyte being also heated. The patent relates principally to the apparatus for producing the circulation, which is continuously maintained by a pump, the electrolyte being caused to traverse through a cycle. It is stated that by the means described a current density of 100 amperes to the square foot may be maintained.

COMPOSITE ELECTRICAL DISTRIBUTION.—Recently we printed an account of a patent granted to Dr. Frederick Bedell on the distribution over the same circuit of direct and alternating currents, and a year or more ago an account was given of a composite distributing system invented by Dr. Pupin, in which apparatus operating at different frequencies are supplied from the same circuit. Still another composite system of distribution is the subject of a patent issued Nov. 12 to Professor E. Arnold and two associates, to which the name "Dependent Polycyclic Current Distribution," is given by the inventors. From the preamble it appears that the patent just issued is subsidiary to another not yet granted. This system provides for the distribution of alternating currents of different frequency employing conductors in common, and the employment of transformers having secondary circuits for deriving currents of different frequency from the said conductors, no choking coils being employed. If two systems are superimposed, they possess one terminal and one conductor in common. The current of one system when the other is unloaded can flow through the common conductor, but when the latter system is loaded then the current of the first system can take two paths from the generator or transformers to the place of consumption—namely, one path through the common conductor and a second path through the other system, and its receiving apparatus. While both systems are theoretically not independent of each other, practically the effect of a change of voltage of one system due to a great change of load of the other system, is negligible.

AROUND THE WORLD IN AN AUTOMOBILE.—Our Cincinnati correspondent informs us that Mr. Edward V. Wilbern, a banker and clubman of that city, is making arrangements to make the trip around the world in an automobile. He will take a steamer from New York to a French port. He will then cross France, Germany, Russia and Siberia, following the line of the Trans-Siberian Railway through the latter country. After touring Japan he will cross the Pacific Ocean by steamer to California, and then ride home in his automobile. He expects to make the circuit of the globe in 300 days.

FRANKLIN INSTITUTE MEETINGS.—Among other papers the following will be read at the meetings of the Franklin Institute during November and December: Nov. 20, "The Organization and Work of the National Bureau of Standards," by S. W. Stratton, director; Nov. 21, "The Electrical Arts at the Pan-American Exposition," and "The Edison Storage Battery," by Dr. A. E. Kennelly; "Polarization in Batteries," by C. T. Reed. Nov. 27, "The Divisibility of the Atom," by Dr. A. S. Mackenzie. Dec. 11, "The Constitution of Metals and Alloys," by William Campbell. The papers for other meetings will be announced later.

ELECTRIC POWER ON THE NEW YORK ELEVATED.—President George J. Gould, of the Manhattan Elevated Railway, at the annual meeting of the stockholders on Nov. 13, made some definite statements in his report with regard to the work of equipping the roads with electric power. The central power station at East Seventy-fourth Street and sub-stations at Allen Street, Thirty-fourth Street and Ninety-ninth Street, are completed, and the machinery is being rapidly installed in all of them. Motor equipments are arriving in quantity and deliveries of 300 new cars will begin within two weeks. It is expected that the first 8000-hp engine and dynamo will be turned by Dec. 1, and the first train on the Second Avenue line run during the month.

CATS CAUSE TROUBLE.—A cat climbed a pole of the Buffalo & Lockport Electric Railway one day last week at Hoffman, N. Y., and while attempting to walk along one of the feed wires her tail touched one of the 22,000-volt Niagara transmission lines. Instantly there was a flash and the cat was killed. The dead body fell across the wires, causing a short circuit, which resulted in the shutting off of the power at Niagara for two hours. In the meantime, several of the electric railways and lighting systems in western New York were without power. The next day (Nov. 14) a cat in Utica, N. Y., prowled around the power house of the Utica Belt Line and came in contact with some live parts. A short circuit was caused, several fuses were blown, and the cars were stalled for some time, but puss still lives.

THE ZOSSEN TESTS.—A special cable dispatch from Berlin of Nov. 16 says: "The experimental trials of the electric high-speed railway between Zossen and Marienfelde, near here, have been signally successful. A speed has been attained equal to 105 miles an hour. The air pressure at this rate was found to be equal to a wind force of 12 ft. a second, a force only registered once on the German coast in a hurricane in February, 1894. The engineers are satisfied that the speed can be increased, although it is the highest ever yet attained by any object mechanically propelled except projectiles." The point of interest in the above is that a speed as high as 105 miles per hour has been attained with an experimental equipment almost at the beginning of the trials. As the preliminary trials were to test the equipment, this apparently has required little or no change in its important details. It will be recalled that the main tests are to be made at a speed of 125 miles per hour.

NOVEMBER MEETING OF THE A. I. E. E.—Systems of electrical distribution form the programme of the November meeting of the American Institute of Electrical Engineers, and the six papers to be submitted will be read and discussed simultaneously in New York and Chicago on the evening of Friday, Nov. 22. The meeting in New York will be held, as usual, at 12 West Thirty-first Street, and in Chicago at the headquarters of the Western Society of Engineers, Monadnock Block. The papers to be read have the following titles: "Distribution of Electrical Energy in Large Cities," by Mr. Louis A. Ferguson. The paper is based on the author's experience in Chicago and his observations in Berlin and Milan. "Locating Faults in Underground Distribution Systems," by Mr. Henry G. Stott; "Alternating Current as a Factor in General Distribution of Light and Power," by Mr. Charles F. Scott; "The Buffalo High-Tension Cable Distribution System," by Mr. Harold W. Buck; "Notes on the Alternating-Current System of Distribution," by W. S. Barstow; "The Distribution by the Three-Phase System, and the Operation of Single-Phase Circuits by It," by W. L. R. Emmet.

WHAT A LIGHTNING FLASH TOLD.—According to a newspaper account, Professor Pickering, of Harvard University, has made some remarkable deductions from a photograph of a lightning flash. It appears from a statement of Professor Pickering that the spectrum of a streak of lightning was photographed last July. "From such a small beginning two discoveries have developed. Not only are the chemical elements so-called compounds, but it is likely that hydrogen itself, which chemical theorists have thought to be the one element of which the others would sooner or later prove to be compounds, seems to be of composite nature." The newspaper account adds that other photographs made at about the same time show the curious fact that the spectrum of lightning is not always the same. Some of the photographs show a doubling of the bright lines. Professor Pickering was at first inclined to believe that this was a sort of composite photograph, but he now concludes that the doubling looks as though hydrogen, the only element studied in the lightning spectrum, and hitherto believed to be least likely ever to be proved a compound body, is made up of at least three components. This conclusion he bases upon the fact that there were 30 lines in the hydrogen spectrum on one photograph, three in another, and one in the third, the different flashes having been photographed under different circumstances. Another remarkable circumstance is that the spectra are similar to that of the second new star in the constellation Perseus, known as Nova Persei No. 2.

REDUCING THE CHARGING CURRENT OF TRANSMISSION LINES.—As is well known, one of the drawbacks to long-distance power transmission is the amount of current required to charge a line due its capacity. In a paper recently read before the American Institute of Electrical Engineers by Dr. F. A. C. Perrine, it was stated that in one long-distance plant the amount of charging requires 1500 kilowatts of the capacity of the generating plant. In a patent issued Nov. 12 to W. M. Mordey, of London, means are described for removing this difficulty by enabling the so-called wattless charging current to be produced without increase of the size of the generating plant. Another object of the method is to lessen the danger of a rupture of the insulation of cables having considerable capacity, which arises at times from suddent changes of load or otherwise. The method consists in placing one or more choking coils in parallel with the mains. If properly designed and proportioned, such a coil or coils will take a wattless current opposite in phase, and as nearly as may be equal in amount to the wattless capacity or charging current of the mains. By this means the generator will merely keep up the pressure, working with a power factor of unity and sending out only the energy current for the choking coils, which by suitable designing may be reduced to insignificant proportions, and any energy current required to supply the loss by leakage, by dielectric electrical hysteresis in the mains, and the loss in the conductor due to the working current. The idle current, which is alternately a capacity current with a positive phase displacement, and a self-induction current with a negative phase displacement, passes to and fro between the mains and the choking coil at each reversal of the e. m. f., and thus does not entrench upon the capacity of the generator. The choking coils also provide a path or paths for the harmless discharge of current or the relief of high pressure, which otherwise may be productive of serious consequences, and which may arise, for instance, in the case of violent fluctuations from various causes. In such cases the choking coil has a double effect—it tends to reduce or to limit the main circuit of excessive pressures, and it acts as a relief valve or outlet and so prevents breakdown of insulation or sparking between the mains or to earth. The specifications describe in detail the construction of choking coils for the purpose of the invention, which are made of the lowest practical resistance and to require a minimum of energy for magnetization. They also have an adjustable air-gap to enable the strength of the idle curent supplied or taken by the coil, to be regulated to a certain extent.

AZORES CABLE.—It is stated that the Commercial Cable steamer, the "Faraday," has sailed from Waterville to lay another cable between this country and Fayal, Azores.

GIRL MESSENGERS.—At Cleveland, Ohio, the Council of Jewish Women has denounced the employment of girls as telegraph messengers. A few weeks ago a local telegraph company hired girls as an experiment. The innovation was successful, and most of the boys were dismissed.

TUNING TELEPHONE VOICES.—It is stated that under the tutelage of the Chicago Telephone Company 900 female voices are being given an elocutionary training. The company now requires that operators on the long-distance lines must be proficient in this new art, known among the officials as "telephonic elocution." The pitch, the modulation, the elasticity of the voice are all given special attention, and also many smaller details. The proverb of Solomon that a soft answer turneth away wrath is also inculcated into the minds of the operators, so that it becomes second nature with them to reply sweetly to an irate subscriber.

THE PACIFIC CABLE.—Representative Hepburn, of Iowa, chairman of the Inter-State and Foreign Commerce Committee of the last House, and Representative Sherman, of New York, a member of the same committee, had a long conference with the President last week about Isthmian canal and Pacific cable legislation. As a result of the consultation they announced that it was their purpose to press legislation on both subjects at the earliest possible moment. The cable bill will be practically identical with the one reported from the committee in the last Congress. It provides for the laying of the cable by a private corporation under a contract with the Postmaster General, with an alternative provision for the building of the cable by the Government if no satisfactory contract can be made. It is understood that the President concurred in the proposed programme.

ELECTRIC FURNACE.—A carbide furnace recently patented to James H. Morley, of Springfield, Mass., and appertaining to that type in which a vertical depending electrode is used in connection with interchangeable carbon hearths constituting the opposite terminal, presents, in addition to the usual complement of devices for automatic charge feed and current regulation, a point of decided novelty as regards the carbide art. This lies in the construction of the upper carbon, which is fashioned as a tubular rectangular prism, and is fitted with mechanism for imparting to it a reciprocating rotary movement about its longitudinal axis, whereby the surrounding charge is continuously loosened and stoked into the arc. The central perforation communicates above the furnace with the air, and the movement of the furnace gases serves to induce through the carbon a downward current of air, which not only prevents overheating, but by introducing the air at the very point of liberation of the reaction gases, is said to prevent the occasional explosions of gas which otherwise occur near the fusion zone.

STORAGE BATTERY PLATE.—Mr. Leonard Paget, of New York, has patented under date of Nov. 12, an interesting method of making storage battery plates of the type in which a grid or support is dispensed with, the active material being itself hardened into a strong and light plate, with which connectoin is directly made by soldering or otherwise. The composition used consists of 4 parts of litharge or other oxide of lead, 1 part of lead sulphate, and from 1 to 2 parts of zinc dust, the ingredients being mixed dry, pressed into shape, and while under pressure carefully and evenly moistened with water. Reaction ensues rapidly, the zinc reducing the lead from its sulphate and the mass hardening at once to a stone-like composition. The zinc sulphate must then be washed out, an operation best effected in an electrolytic vat in which the plate is connected as cathode, whereby the rate of solution is somewhat lessened and disintegration of the plate avoided. The plates so prepared are then electrolytically formed as usual and mounted for use in conjunction with any of the ordinary electrolytes.

TRACTION IN LONDON.—A cable dispatch from London of Nov. 13 says: At yesterday's meeting of the London County Council a proposal was unanimously adopted to ask the consent of Parliament to the consruction of subways and a shallow tramway from the Victoria Embankment under New Street to Holborn, connecting a little further north with surface trams. In the course of the session the delegates who recently visited the United States described the systems in Boston and New York, J. Williams Bonn declaring his conviction that what had been done in these American cities could be done in London and that efforts should be made before subterranean London was handed over to foreign control. This statement was greeted with considerable applause. Commenting editorially upon the importance of the decision of the County Council, the *Daily Chronicle* says: "It appears that while the district railways of the metropolis are engaged in a tedious dispute, the County Council and Charles T. Yerkes have entered for a neck and neck race to supply London with cheap and efficient electric traction. We prefer that the Council should be the winner."

METALLIC MANGANESE.—The method long since applied by Hall to the manufacture of aluminum, and later by Liebmann to the electrolytic production of beryllium, and which consists in dissolving the oxide of the metal in a fused fluoride bath and subjecting it to a direct current of sufficient volume to maintain the fusion of the bath and to separate the metal, has now been applied by Albert Simon, of Bordeaux, France, to the production of manganese and its alloys. Manganese is difficult of treatment by ordinary reduction methods, and the electric furnace cannot be economically applied to its production on account of the loss of metal due to its ready volatility at high temperatures. A molten bath, however, fusing at a temperature approximating the melting point of manganese and its commercial alloys, is readily formed, and from this bath the metal or its alloy separates as a cathode product, while any silicon which may be present escapes as gaseous fluoride. M. Simon has constructed a special furnace for the purpose, the distinctive features of which are the use of a protective sheath for the anode composed of a manganese slag containing the metal in its lower state of oxidation, and, therefore, incapable of oxidizing the carbon; and of a series of temporary carbon connectors between anode and cathode, which carry the initial current and bring the bath to an operative temperature. These structural features form the subject of a patent issued Nov. 12.

LETTER TO THE EDITORS.

Switchboard Simplicity.

To the Editors of Electrical World and Engineer:

Sirs.—I have read the interesting article in your issue of Nov. 9 upon "Important Power Station Work at Kansas City," and your editorial comments in same issue under the heading "Switchboard Simplicity," and I am glad to note that Mr. Pierce, in his work at Kansas City, has adopted the diagrammatic pilot switchboard idea which, in my opinion, will contribute largely to certainty and safety in operation of the large and necessarily complicated organizations of power-operated switch gear used in the larger and more modern electric plants. It is interesting to note that Mr. Pierce mounts the switch handles and dummy bus-bars on the face of the instrument board instead of upon a special operating panel or bench board, as in the case of the Manhattan Railway Company's power plant at Seventy-fourth Street and the East River, but I may point out that Mr. Buck, at Niagara Falls, has adopted the same plan in the case of the new plant now under construction at Niagara.

Where all switches connected into the power circuits at the generating station are of a type that may be relied upon to break the power circuits under all conditions, as is the case in the plants mentioned, the location of the diagrammatic pilot board upon the instrument panels is perhaps preferable to the use of a separate bench board, where the instrument board is not too long; but there are arguments in favor of each of the alternative plans. To place the pilot board upon the instrument panels would seem to leave the operator positively no excuse for throwing the wrong switch, but on the other hand, where he is standing close to a given instrument panel and manipulating a pilot switch something demanding his attention may happen elsewhere. If the separate bench board be used, manipulation of the switches does not require him to leave a position from which all switchboard instruments are under his eye.

But there is another argument in favor of the separate bench board

construction which, while it does not apply to the Manhattan or Niagara boards (in which all alternating-current switches are of the circuit-breaking type) may become of considerable importance in connection with organizations of switch gear providing similar connections of alternators and feeders to two sides of bus-bars, but using non-circuit-breaking selector switches for the alternators and the feeder groups. The reason referred to is the fact that where the pilot switches are compactly assembled upon a bench board instead of being distributed along the instrument board, it becomes easy to mechanically interlock the circuit breaking and non-circuit-breaking switches in such a way that the attendant is compelled to open and close these switches in their proper sequence; that is, he cannot open a non-circuit-breaking blade switch before he has opened a circuit-breaking switch in series therewith, and he is compelled to first close an automatic circuit-breaking switch, connected into a feeder, for example, before he can close the selector switch in series with it. In other words, it is convenient with a bench-board arrangement to mechanically interlock the switches and circuit breakers much in the same manner as railway switches are interlocked by the operating mechanism in the switch towers of large railway yards and terminals.

It would probably not be difficult to adopt this interlocking idea in connection with the pilot bus-bars and switches even when the latter are placed upon the instrument panels, but it is somewhat more conveniently accomplished when they are compactly assembled upon a bench board.

NEW YORK. L. B. STILLWELL.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Properties of Armatures with Commutators when Used with Alternating Currents.—LEBLANC.—A short article in which he endeavors to show that certain conceptions concerning the action of armatures with commutators when alternating currents are passed through them, are incorrect. Although the new Heyland motor (see Digest, Aug. 31), is not directly mentioned, yet an editorial foot note refers to the description of that motor, which immediately follows the article. He states that for some time past, new properties have been claimed for armatures with commutators, which would have a great industrial importance (such as in the Heyland motor). He states these properties as follows: "It would be possible to have a magnetic flux produced by one of these armatures by sending into it alternating currents of a frequency f, by the use of brushes resting on the commutator, without having to overcome other impedance than that due to the resistance of the circuits, the only condition being to communicate to the brushes a speed in a suitable direction with reference to the commutator, relatively equal to f. If this relative speed is equal to $f—U$, the impedance which one would have to overcome would be the same as if, the relative velocity being zero, one would send into the armature through the brushes, currents of the frequency U." He then discusses this question by showing what would happen in such cases, and states that he does not believe that these properties have ever been found to exist, and that the above mentioned statements are incorrect. He first discusses the phenomena in the armature when the brushes continue to rest on the same commutator bars, and then those due to commutation. Concerning the former he shows that the e. m. f.'s developed between the brushes are the same as those between the primary terminals of a polyphase transformer, of which the secondaries are closed through resistances. If these resistances are great relatively to the secondary circuits, which should always be the case, the e. m. f.'s developed between the brushes are made wattless with relation to the currents which pass from one brush to the other. Also that the impedances which must be overcome are independent of the speed of rotation of the brushes, as the frequency of the currents in the sections of the armature is always equal to f during the time under consideration. He concludes that "if we send K polyphase alternating currents into an armature with commutator by means of K brushes successively displaced by angles equal to 360 degs. divided by K, the e. m. f.'s which it is necessary to develop between the various brushes to cause the current to pass, are the same whether the brushes remain stationary or whether they revolve with relation to the commutator." One can, however, make use of the properties of such armature in alternating-current machines for producing fluxes capable of revolving with respect to them, without requiring that the currents which pass through these circuits have to overcome any other impedances than the one due to the resistance of the circuits, but it is necessary to do it otherwise. He does not say how. In conclusion, he calls attention to his French Academy paper of July 29, 1899 (which is reproduced as a foot note), and which describes a self-starting, alternating-current motor or variable speed, in which a Gramme armature with collectors is used.—*L'Eclairage Electrique*, Oct. 26.

New Alternating-Current Machines.—BUNET.—There is considerable discussion, he says, at present concerning new alternating-current machines, most of which, however, he believes are based on incorrect principles. He believes the results obtained would be very different from those hoped for by the inventors. A principle on which a number of them are based is as follows: "It is possible, by virtue of certain devices, to excite a magnetic field in such a way as to produce a certain flux, by using alternating currents in the coils, without having to furnish a wattless current, or, if one prefers, without self-induction." He believes, however, that quite the contrary is true. Also that it is also impossible to make a self-exciting alternator without being obliged to use special devices for creating the field, using a special current, or modifying the current of the machine for producing the field. He does not wish to say that it would be absolutely impossible by means of certain discoveries to obtain that which these inventors have sought, but thinks it is useless to try to do it with their present means, or in other words, he believes that some discoveries must first be made. He discusses what is claimed will take place in a Gramme armature with a commutator and revolving brushes through which alternating currents are passed into the armature, and then goes on to show that the above claims are incorrect. In the first place the field obtained is never a constant one revolving with a constant speed, but it is of an elliptical character, thus causing parasitic e. m. f.'s and sparking at the brushes, but there is a remedy for this, and the objection is, therefore, only of secondary importance. Suppose a continuous current is sent through a Gramme ring as usual by means of two brushes. If the armatures of the brushes are rotated at any velocity, the field will rotate with reference to the windings, that is, the poles will always follow the points of the application of the brushes. No e. m. f.'s will be induced either in one direction or the other, and the difference of potential necessary to cause the current to pass will always be the same whatever the speed even for a speed equal to zero, neglecting the action of the coils under commutation. If in place of a continuous curent, an alternating current is used, there will be found to be a certain induction which remains the same for all relative displacements of the armature and brushes. Such an armature for alternating currents, he shows, will have the same self-induction which it would at rest, when the armature and the brushes have any relative speeds whatever. He believes he has thereby demonstrated the fallacy of the principle that the self-induction, when the armature or brushes rotate, is zero. A revolving field is often for convenience represented by a permanent magnet revolving at the same speed, but he claims that they are not identical and that the analogy should not be carried beyond where it is legitimate. He discusses the general case of the movement of the brushes, and the field in such an armature, and shows the oscillating action of the field as the brushes pass over the commutator bars. He summarizes his conclusions as follows: "The flux is balanced around a mean position; its displacement in one direction acts on the stationary circuits; its displacement in the reverse direction does not act on the circuits movable with it in the same direction." If commutator bars are connected by resistances, as has been suggested (by Heyland), the case will not be different, and there will simply be a useless consumption of energy.

(The Heyland motor described in the Digest, Aug. 31, and in ELECTRICAL WORLD AND ENGINEER, Sept. 28, page 492, is not referred to by name, but is apparently one of those to which the criticisms refer). He concludes by saying that he is led to believe from his arguments that a revolving Gramme ring cannot be considered as being without self-induction for any currents whatsoever, and that the only difference, from this point of view, between such an armature and one that is fixed, are of a secondary order, and are disadvantageous. These differences are chiefly in sparking and loss of energy due to commutation.—*L'Ind. Elec.*, Oct. 25.

Operation in Parallel of Alternators Run by Tandem-Compound Engines.—GARFIELD.—A communication referring to a fomer article on the electric railway between Milan and the Italian Lakes, in which a statement was made that the alternators, which are direct coupled to tandem-compound engines, are run in parallel, and that this fact might introduce certain complications. He says that after running for some time in regular service no trouble has been experienced. The total weight of the flywheel is 36 tons, of which 27 tons is in the rim. The revolving parts of the generators weigh 17 tons. The writer also says that generators operating under similar conditions are in use in certain other plants. Balanced poppet valves are used throughout, and this type of valves has been very well suited for use with superheated steam.—*St. R'y Jour.*, Nov. 2, and Int. Ed., Nov.

REFERENCE.

Theory of Shunt-Wound Dynamos.—BERNARD.—A brief illustrated note on the graphical construction of the characteristic curve for the behavior of a shunt-wound dynamo.—*Elek. Zeit.*, Oct. 24.

POWER.

Electric Power in Shipbuilding Works.—An illustrated description of the electrical equipment of Palmer's shipbuilding works at Jarrow-on-Tyne. The shipbuilding department and the engine department have recently been equipped with elctric apparatus for all power purposes. When the installation was made, the works were exceedingly busy, and a system, the installation of which interfered least with the continuous output of the works, was chosen. The long lengths of shafting and the numerous belts and pulleys were practically retained in their entirety, the steam engines were each replaced by a three-phase induction motor, and the steam plant centralized at one point, the electric generating station. The result is "a considerable reduction in the quantity of fuel consumed for the power generation," but no exact figures are given. There are two steam-driven 750-kw, three-phase alternators, and in all upwards of 80 induction motors in use, aggreating a total capacity of 1500 horse-power.—Lond. *Eng'ing*, Nov. 1.

Electricity in Mines.—GOETZE.—An illustrated paper, read before the German Soc. of Mining Engineers, on applications of electric power to mines in Germany. Six large German electric companies furnished 15,000 kilowatts of plant for mines in 1898, 27,500 kilowatts in 1899 and 46,600 kilowatts in 1900. A characteristic feature of this great progress was the general introduction of the three-phase system, and the use of e. m. f.'s of 2000 to 3000 volts. He discusses at some length the use of electric pumps, which he shows to have the advantages of greater economy and less trouble in operation. He further discusses the use of electric power for driving ventilators and hauling machines. For large hauling machines direct current is preferred sometimes in combination with storage batteries, although the three-phase system is also used for this purpose. With the three-phase system, water resistances are often used for starting. To avoid the water getting heated to the boiling point, the water is continually circulated by means of a small pump.—*Glueckauf*, Oct. 19.

Refuse Destruction.—PRIESTLEY.—An abstract of a paper on refuse destruction at Nelson. He gives the results of recent tests on a furnace of the Pheldrum regeneration type, by which all the refuse of the town of Nelson is destroyed. He describes in detail the means adopted for determining the temperature in the combustion chamber. The results of a test, extending over one month from Feb. 19 to March 16, are given. He brings out the average evaporation of water per pound of refuse from and at 212 degs. F. to 1.85 lbs., and this result is almost identical with that obtained during a short-hour test. No details are given regarding the cost of the process.—Lond. *Elec. Rev.*, No. 1.

REFERENCES.

Italian Water-Power Plant.—BIGNAMI.—An illustrated description of the water power and electric installation at Vizzola-Ticino, Lombardy, for transmission to Milan and numerous smaller manufacturing centers. At present 19,000 horse-power are developed. Later there will be 24,000 horse-power.—*Eng. Mag.*, Nov.

Canadian Water-Power Plant.—An illustrated article on water power development at Shawinigan Falls, Quebec. Power is supplied to the new aluminum plant of the Pittsburg Reduction Co. and to the Belgo-Canadian pulp mill.—*West. Elec.*, Nov. 2.

TRACTION.

Three-Phase Traction.—A communication by Brown, Boveri & Co., on the electrification of the Metropolitan railways in London. It is denied that there is any necessity of calling the proposal of three-phase traction by Ganz & Co., a new system—the Ganz system—as there is nothing new about it. Cascade (concatenation) control of induction motors is not thought to be "the" solution of the problem. When they studied in 1895 their first three-phase line, the Lugano tramway, they tested the cascade system, but found that it presented no advantages, and that the total starting torque obtained by switching two motors in tandem was smaller, instead of greater, than that obtained with one motor alone. Later on, when designing the Burgdorf-Thun railway equipment, they repeated these experiments and obtained the same results. They prefer to adhere to the ordinary resistance control until they can find an equivalent to the series-parallel control, which is sure to be invented sooner or later. They claim the simple resistance control is not so bad after all. On the Burgdorf-Thun line they start heavy trains on the level with an acceleration as high as 1½ ft. per second, without taking more current from the line than the normal current. The Burgdorf-Thun railway has now been running on full service for two years and a half, and during this time no repairs whatever have been necessary on any of the motors. The winding and sliprings are as good as new. They have not had to replace a single bearing brush, and the small air-gap, which everybody declared would turn out to be a continual source of trouble, has caused none whatever, not even a minute's stop.—Lond. *Eng'ing*, Nov. 1.

New Orleans & Carrollton Railroad.—Many of the streets in New Orleans are laid out with a strip of turfed ground in the middle of the street. This is called neutral ground, and makes an ideal place for street railway operation, as the grass is allowed to grow nearly to the top of the rails, and there is no dust raised by the passage of the cars. The New Orleans & Carrollton Railway has about 33 miles of track and 100 cars. The track on the neutral ground is laid with T-rails weighing about 100 lbs. per yard. A careful record is kept of the life of all parts, as well as the mileage of all cars, and when a car has run from 15,000 to 20,000 miles new armature bearings are installed, and the whole equipment is carefully overhauled. Some particulars are given as to the life of other parts of the equipment. Owing to the spongy soil in New Orleans, the use of pits in the repair shops was not feasible, and instead the cars are run on elevated tracks. This allows the use of a convenient device for the removing and replacing of wheels. Compressed air is used for cleaning motors, registers and controllers and removing dirt and scale from the trucks which are to be painted. It is also used for car cleaning and sweeping the floor. A record of the cost per kilowatt-hour of the company shows that this varied during the last year from 7.7 mills to 9.2 mills. Other detailed expenses and life of various parts are also given.—*St. R'y Jour.*, Nov. 2, and Int. Ed., Nov.

REFERENCES.

Budapest.—SPAENGLER.—The first part of a well illustrated paper on the changing of the Budapest horse car lines to electric operation. The conduit system is used in the central part of the city and the trolley in the suburbs.—*Zeit. des Oest. Ing. u. Arch. Ver.*, Oct. 18.

Association Meetings.—An account of the proceedings, and all papers and reports presented before the Am. St. R'y Ass. and the St. R'y Accountants Ass. of America, are published in *St. R'y Jour.*, Oct. 12, 19, 24; also Int. Ed., Nov.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

British Lighting Station.—An illustrated description of the Keighley electricity works. There are three steam-driven dynamos, two of 120 kilowatts, and the third of 200 kilowatts. They are shunt wound for lighting purposes, but can be used as compound generators for the future traction load by cutting in series coils, with a range of voltage from 460 to 550 volts. There is also a balancer-booster set, consisting of a pair of balancers which can supply a load of 50

kilowatts out of balance, direct coupled to two boosters giving 100 amperes each at from 20 to 30 volts for charging the batteries. The batteries consist of 256 cells, with a capacity of 700 ampere-hours.—Lond. *Elec. Rev.*, Oct. 11.

REFERENCE.

Storage Battery and Sixty-Cycle Railway Synchronous Converters.—REYNOLDS.—A description of a plant at Hamilton, Ont., where storage batteries are used in connection with 60-cycle synchronous converters. Power is obtained from a waterfall 34 miles distant, and is transmitted at 22,000 volts, to the sub-station containing three 300-kw converters with transformers, storage battery, etc. The battery is operated in parallel with the direct-current side of the converter, and enables the latter to run steadily so that incandescent lights and railway cars can be run from the same bus-bars.—*St. R'y Jour.*, Nov. 2, and Int. Ed., Nov.

WIRES, WIRING AND CONDUITS.

Resistance of Dielectrics.—ASHTON.—A paper, with numerous tables and diagrams, on the resistance of dielectrics and the effect of alternating e. m. f. on the insulating properties of india rubber. His principal results are as follows: In the case of an okonite cable the current during the first hour's electrification increases as the charging pressure increases. This does not necessarily prove that the dielectric does not follow Ohm's law, since the true conduction current must be considerably less than the total current unless electrification is continued for very lengthened periods. In the case of an okonite cable and a paraffin paper condenser, the charging current is a power function of the time reckoned since electrification commenced, and on this may be superimposed a current of true conduction. For the okonite cable, the mica, and the paraffin paper condensers, the discharging current is a power function of the time, which has elapsed since discharge began. The only deterioration in insulating properties of india rubber due to alternating pressure was in the case of pure Para, and appeared to be due, not to any effect of alternating stress on the rubber itself, but to chemical action taking place between the rubber and gases produced by the action of alternating stress on the air.—*Phil. Mag.*, Nov.

ELECTRO-PHYSICS AND MAGNETISM.

Magnetizing Action of Lightning.—POCKELS.—A note giving some further results of observations in which a rod of basalt had been placed close to a lightning rod and from the permanent magnetization of the basalt rod conclusions were drawn regarding the maximum current of lightning discharge through the lightning rod. The observations have been made on the observatory of Monte Cimone. In one case he found the maximum current at 8600 amperes. In a few cases it was found that the basalt rod had not been magnetized.—*Phys. Zeit.*, Oct. 15.

REFERENCES.

Change in Dimensions Caused by Magnetization in Iron.—RHOADS.—An account of experiments made to investigate the relation between the changes of length and width in a long, thin specimen due to its magnetization. He has not been successful in settling this point as yet, but has obtained good curves for the change of length.—*Phil. Mag.*, Nov.

Electromagnets for Lifting.—An illustrated article on the use of lifting electromagnets in combination with cranes for loading and unloading metallic plates, etc.—*Sc. Amer.*, Oct. 26.

ELECTRO-CHEMISTRY AND BATTERIES.

Freezing Points of Dilute Solutions.—GRIFFITHS.—An abstract of a Brit. Ass'n paper in which he gave a summary of his work which has now lasted four years. He has made more than a thousand experiments, each taking about 1½ hours, with pure water alone. The subject is of great importance for the dissociation theory. When any salt is dissolved in water the freezing point of the solution is depressed. According to Raoult, quantities of substances proportional to their molecular weights, produce the same depression. If electrolytes are in solutions dissociated into ions, as the modern theories assume, the freezing point depression should be two, three, etc., times larger than in the case of non-electrolytes like sugar, according to the number—two, three, etc.—of ions. The proof that the partial dissociation becomes complete with extreme dilutions had so far not been given by the freezing point method. No two observers agreed quite about very high dilutions, as then the impurities of so-called pure water, make their influence felt very strongly. The present author arrives at the conclusion that the freezing point depression in the chlorides of potassium, sodium and barium, is really twice as much as for cane sugar. "Thus, as Professor Ramsay expressed it, the dissociation theory is placed on a firm foundation."—Lond. *Eng'ing*, Oct. 4.

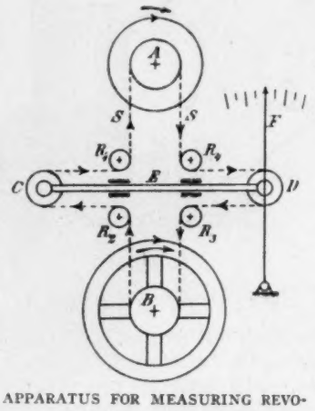
REFERENCES.

Alkalies and Chlorine.—A continuation of the illustrated review of new patents on the electrolytic production of alkalies and chlorine. Among other things the gradual development of the "bell process" (gravity process without diaphragm) is described.—*Zeit. f. Elektrochemie*, Oct. 10.

Migration Velocity of Ions.—JAHN.—An account of a redetermination of the transport numbers of the kation in dilute solutions of the most important salts and acids.—*Zeit. Phys. Chem.*, July 12; abstracted in *Science Abstracts*, Oct. 25.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Determining the Degree of Uniformity of the Revolution of Prime Movers.—FRANKE.—An illustrated paper read before the Ass'n of German Elec. Eng. The "degree of non-uniformity" is defined as the difference between maximum and minimum speed divided by the average speed during one revolution. He points out that any machine which has not an entirely uniform speed during one revolution, also invariably shows at constant load some variation of the number of revolutions per minute. He describes quite a number of methods for measuring the degree of non-uniformity during one revolution. In the first group of such methods the distances passed over in equal time are compared or else the times for equal distances. In the second group of methods the variation of the non-uniform rotation from a uniform rotation made at the same time is investigated. In the third method the speeds at different phases of the revolution are directly measured. In a frequently used method of the first group, a vibrating tuning fork describes a curve on a cylinder revolving on the axle of the prime mover, but there is an error in this method due to the fact mentioned above, that the number of revolutions per minute always varies. To the second group belongs the well-known stroboscopic method. An apparatus of Schaefer and Budenberg for plotting the curves of movement, is described. Another very simple, but not very accurate apparatus for measuring the degree of non-uniformity is shown in the adjoining figure. *A* is the shaft of the prime mover to be tested, *B* is the shaft of a flywheel revolving with uniform velocity, R_1 R_2 R_3 R_4 are fixed rollers, *C* and *D* loose rollers connected together by a rod; *S* is a rope, running around the axles *A* and *B* and the six rollers. When *A* runs quicker than *B* the rope is tightened in the part *C* R_1 *A*, and gets loose in the part *A* R_4 *D*, with the result that the rod *C D* with the two loose rollers is moved to the right hand and deflects the needle *F*. The deflections of the needle may be plotted. Several other methods, belonging to the same group, are also described. He believes that methods of this group are well adapted for demonstration purposes, but cannot be made exact enough for fine measurements. Nor are the methods of the third group satisfactory for very exact measurements. When the speeds are measured at different phases of the revolution, they would give exact results, if the prime mover always made the same number of revolutions per minut, but this is not the case, as mentioned above. Methods in which this source of error is overcome are very complicated and not suitable for use in practice. He concludes that the measurement of a "degree of non-uniformity," smaller than 0.01 is not possible with out present instruments and methods. The electrical



APPARATUS FOR MEASURING REVOLUTIONS OF PRIME MOVERS.

engineer, in specifying prime movers for driving dynamos, and especially alternators for parallel operations, should not require a smaller degree of non-uniformity than 0.005.—*Elek. Zeit.*, Oct. 24.

Electrograph for Atmospheric Discharges.—A brief illustrated description of an electrograph, devised by Lancetta, for registering the electric discharges of the atmosphere. A coherer is in series with a battery and a galvanometer. When an atmospheric discharge acts in the coherer and renders it conductive, the galvanometer needle is deflected and closes the circuit of a vibrator. This causes the registering device to make a mark on the registering cylinder. A ball then strikes the coherer and brings it back to its normal state.—*Sc. Am. Sup.*, Nov. 9.

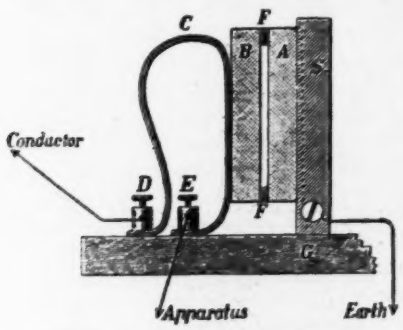
REFERENCES.

Lippmann Electrometers.—Craw and Cottrell.—Brief abstracts of two Brit. Ass'n papers. The one paper, by Craw, deals with the effect of non-electrolytes on the Lippmann electrometer. He finds Nernst's view, that non-electrolytes should have no effect not confirmed. The other paper, by Cottrell, deals with the theory of the capillary electrometer. He thinks that the Helmholz-Lippmann theory cannot in general be correct.—Lond. *Eng'ing*, Oct. 4.

Voltameter Balance.—Pfanhauser.—An illustrated description of a voltameter balance. The cathode is suspended on the one arm of a balance. When the needle of the balance is on zero, the circuit is automatically broken and an electric bell gives the signal that the desired number of ampere-hours has been obtained and that the electrolytic process has been interrupted. The instrument is adapted especially for the silvering of weights.—*Zeit. f. Elektrochemie*, Oct. 10.

Telegraphy. Telephony and Signals.

Coherence Phenomena in Carbon Lightning Arresters.—Gansange.—An article on carbon lightning arresters used for protecting telephone instruments. The construction is shown in the adjoining diagram. *G* is a wooden baseboard supporting a metal plate *S* connected to earth. A number of plates, equal to the number of lines to be protected, and made of compressed carbon, are fixed in a series of parallel grooves in *S*, and against each of these plates *A* is pressed a second carbon plate *B* by a steel stirrup spring *C*. The plates *A*, *B* are kept apart by two insulating blocks *F*, about 0.08 inch thick, and have their inner edges serrated to facilitate discharge between the plates. The line connectios are at *D* and *E*. In ordinary working no current passes from *B* to *A*, but if the line is struck, or inductively acted on by lightning, a discharge takes place along this path to earth rather than along the high-inductive path through the telephone instruments so that no damage is done to the latter. The carbon plates of the lightning arrester must be very carefully dusted when setting up the instrument, otherwise carbon dust is liable to settle on the insulating blocks *F* and destroy the insulation. This insulation may not be destroyed at once, but only after a spark has passed with the result that the dust coheres and forms a short circuit, as in coherers used for wireless telegraphy. It is, therefore, necessary when testing the insulation, to first pass a spark between the plates *A* and *B*, otherwise the instrument may appear all right, but after a time suddenly go wrong, owing to a short circuit produced by a discharge between the plates, due to atmospheric causes. Microphones consisting of carbon particles, mixed with carbon dust, are also liable to be affected by these coherence phenomena, and the noises sometimes heard in telephones, when the circuits are not in use, may be explained in this way.—*Jour. Teleg.*, May; abstracted in *Science Abstracts*, Oct.



CARBON LIGHTNING ARRESTER.

Automatic Train Recorder.—A description of the automatic train recorder of the Brooklyn Rapid Transit Company, which consists of a circular record sheet of paper ruled in concentric circles and placed in the general manager's office. The sheet is revolved by clockwork, and is divided by radial lines into five minutes' spaces. In front of the sheet are several needles operated by electromagnets, each needle being operated from a different section of the elevated lines. The track of the elevated lines at these sections is supplied with a length of insulated rail, and the cars in passing over this portion energize through a system of instruments the magnets of the needles and produce a dot in the record sheet. In this way the manager has before him at all times an absolute record of the number of trains and their frequency on any division of his lines. Means are provided in the mechanism whereby the needle makes an instantaneous punch in the disk, and is then released so as not to retard the movement of the clockwork.—*St. R'y Jour.*, Nov. 2, and Int. Ed., Nov.

Wireless Telegraphy.—A note, taken from the daily press, stating that Marconi has succeeded in sending messages over a distance of 350 miles, and that he has offered to give a demonstration to the British Admiralty of wireless telegraphy over a distance of 500 miles. —Lond. *Elec. Rev.*, Nov. 1.

REFERENCES.

Telephony.—Wietlisbach.—The first part of a reprint of a series of articles on telephony. After an introduction on the history of telephony and on the theory of sound vibrations, the construction of the telephone is described in detail.—*Tel. Mag.*, Oct.

Telegraph Repeater.—An illustrated description, taken from a United States patent specification, of a new automatic telegraph repeater, devised by Cordovez.—*Sc. Amer.*, Oct. 19.

France.—The first part of a reprint in full of the new regulations which have been introduced in France on Oct. 1 for telephony, regarding the tariff, the installation and maintenance of the lines, etc.—*L'Elec.*, Oct. 12.

Miscellaneous.

Electric Burner for Blast Furnaces.—Grammer.—An abstract of a paper read before the Am. Inst. of Min. Eng. In starting new or abandoned plants with untrained labor, and in running some of the large 100-ft. furnaces, slips which result in very cold furnaces, may occur, even under experienced managers. When he experienced such a misfortune, the elctrician proposed to open the tuyerers and cinder-notch by means of the heat of the electric arc. This was very successful, and he recommends making a permanent installation for this purpose, as it is badly needed in such cases.—*Eng. and Min. Jour.*, Nov. 9.

Aluminum as a Substitute for Copper.—An editorial. It may be assumed to be possible to substitute aluminum for copper in electrical work to a considerable extent, provided the metal can be had in sufficient quantities for the purpose. The latter is the most important question. In 1900 the total production of aluminum in the world was 5570 metric tons, of which the United States furnished 2053 tons, while that of copper was 492,625 metric tons, of which 272,536 tons were supplied by this country. That is, the total output of aluminum last year was only 1.1 per cent that of copper. Until these figures are greatly changed, the competition of aluminum is not likely to affect the copper market.—*Eng. and Min. Jour.*, Nov. 9.

[The supply of aluminum, unlike that of copper, is purely a manufacturing question, and practically only dependent on the demand.]

REFERENCE.

British Manufacturing Company.—An illustrated article on the Electric R'y & Tramway Carriage Works and the English Electric Manufacturing Company, at Preston, and especially on direct-current generators for light and power, made by the latter company. The title of the article is "American methods in English manufacture."—Lond. *Lightning*, Oct. 10.

A New Type of Surface Contact Traction System.

Of the numerous surface contact systems that have been proposed, the well-known one of Diatto has demonstrated some points of value in practical operation on one or more street railway lines in France. The system which we illustrate herewith, the invention of Mr. L. M. Maxham, has many points in similarity with the Diatto system, and appears to be mechanically a considerable advance over that system. As will be recalled, in the Diatto system the contact is made through the attraction by a magnet carried on a car, of a contact plunger floating in mercury, the weight of the plunger being partially sustained by the mercury. In the Maxham system, while mercury is used as

the means of contact, the plunger itself is made so light that the use of mercury floatation is obviated.

Briefly, the system consists of a sectional third rail midway between the traction rails, each section of which is capable of electrical connection with the feeder system by means of the circuit device above

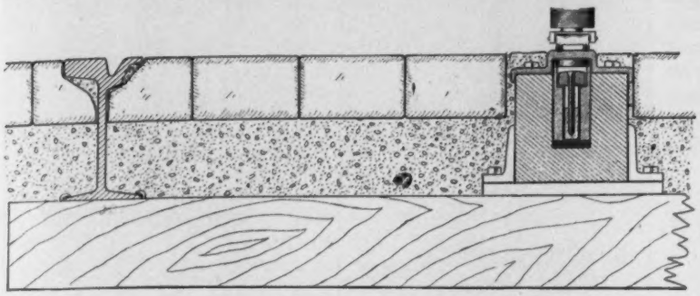


FIG. 1.—CROSS SECTION OF CIRCUIT CLOSER.

referred to. The third rail is normally disconnected from the feeder circuits, but when a car is over a section that section is immediately electrically connected with the feeder system and becomes "live." The means by which this is accomplished is shown in the two accompanying illustrations. Attached to the bottom of the car by a spring suspension is a pair of powerful electromagnets, but which require the expenditure of only a small amount of current in their coils,

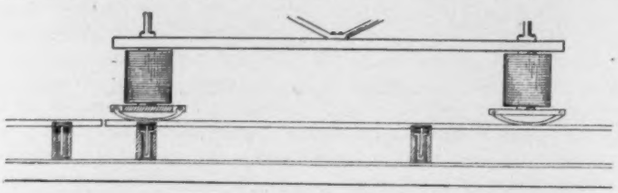


FIG. 2.—DETAIL OF THIRD-RAIL SECTION.

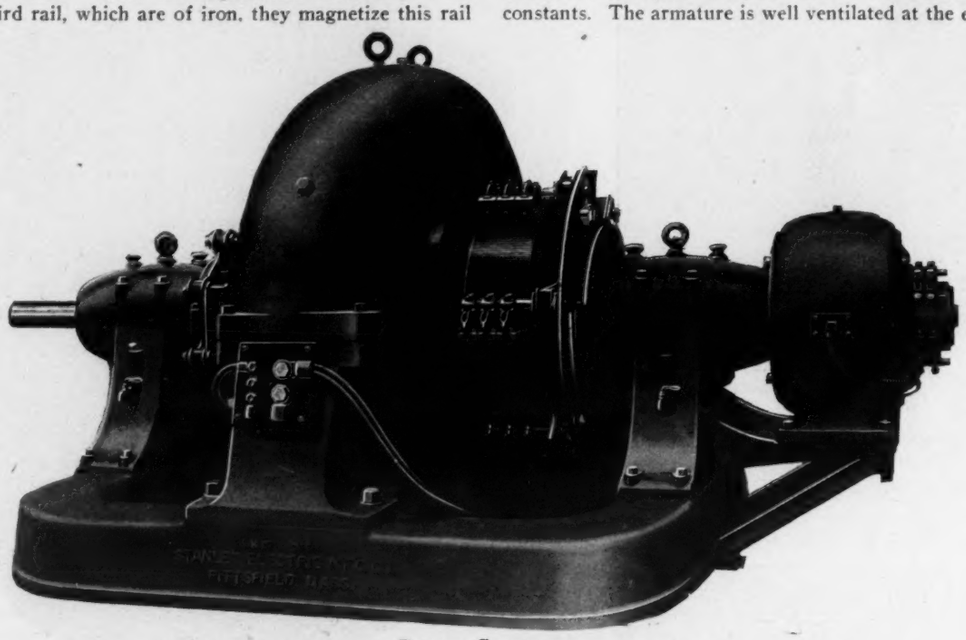
supplied by a small storage battery carried on the car. Under the rail at fixed intervals are placed the small circuit closers, which are shown in Fig. 1 in cross section. These consist of a deep cup made of copper, or aluminum, containing mercury, in which rests an aluminum pin having an iron head. When the magnets are above one of the sections of the third rail, which are of iron, they magnetize this rail and cause it to attract the iron heads of the pins in the circuit closers, raising them up and electrically connecting the bottom of the rail to the mercury. The cup is placed in a porcelain receptacle and directly connected to the feeder system, represented in Fig. 1 as a rectangular bar running below the series of cups. In order that no sticking of the plunger may occur either from residual magnetism or from the fusing of the iron head to the bottom of the rail, the contact is made between a disk of carbon on the rail circuit, and a similar disk on the iron head. The stringer which supports the rail and which forms the insulation for the feeder running under the cups, is made of some insulating material such as reconstructed granite, which not only forms a firm support but thoroughly insulates the electrical system. A form of shoe which can be used for the collecting of the current is shown in the illustrations, but, of course, this being a matter of detail may be modified to suit any assumed requirements.

The height of the top of the third rail above the bottom of the stringer is less than that of a 9-inch girder rail, so that the system can be installed on a road without cutting or interfering with the roadbed. As only the section under the cars is alive there is no appreciable loss from leakage no matter what the conditions of the pavement may be. In order that all danger from leaving a section alive may be obviated, a brush is provided at the end of the car which is grounded on the axle, so that should a section be alive when it is reached by this brush, a short circuit is produced between the third rail and the traction rails, and the circuit breaker on that division is opened immediately, thus cutting out the dangerous section. This condition, of course, is very unlikely to occur, for as soon as the magnetic influence of the third rail has ceased the plungers immediately return to their lower position.

This system is being put upon the market by the Bay State Traction Company, Bennett Building, New York, of which Mr. L. M. Maxham is president and Mr. F. W. Toppan secretary and treasurer. This company, besides promoting this system is also entering the electric railway construction field in all its branches.

S. K. C. Converter.

The illustration shows a Stanley converter, one of several machines recently built for the Detroit, Rochester, Romeo & Lake Orion Railway. The electrical design has been carefully worked out and embodies the experience with this class of machines up to date. The armature winding is thoroughly sub-divided, and a large number of slots are used. This prevents local heating, conduces to good commutation, gives a wave of e. m. f. free from harmonics, prevent eddy current loss in the pole faces, and allows the use of desirable magnetic constants. The armature is well ventilated at the ends, and a number of ducts are placed in the core at short intervals. The coils are held in the slots by means of fiber wedges and by bands at the ends.



ROTARY CONVERTER.

The commutator is built up with a large number of bars. While productive of the best commutating constants they also interpose a high resistance against flashing over the commutator. The mechan-

ical factor of safety of the commutator is high. The alternating and continuous-current brush-holders are mounted independently of the cup bearings. The latter may be removed without interfering with running conditions, thus facilitating continuous operation.

It is not perhaps widely known that small lack of symmetry due to careless erection, accidental causes, or natural wear of bearings may bring on the bearings a pressure which is many times in excess of that due to the weight of the revolving part. In order to forestall any possible trouble from such cause ample bearing surface for all contingencies has been provided. The continuous-current brush-holders give a parallel motion to the carbon and allow of easy adjustment of the pressure. The carbon is easily removed or replaced, and can instantly be thrown out of service should it become desirable.

As will be noted the machine has been made pleasing to the eye, and evidently every care taken to provide a substantial machine in every detail and which may be relied upon for severe, continuous service.

Signs for Street Corners.

Since the disappearance of the gas lamps, which in the old days, if at street corners, often carried, as the survivors still do, the names of the thoroughfares meeting at that point, many complaints have been heard of the difficulty experienced in finding one's way about in such a city as New York. Even a person familiar with the town has difficulty in the daytime in locating himself, and at night the trouble is even worse. The work of the car conductor is greatly added to by inquiries, which, if there were legible signs, would be quite unnecessary.

FIG. 1.—SIGN BROADWAY AND BARCLAY STREET.

In New York City efforts to deal with the problem have been made by the New York Edison Company, and attention is now called to another form of indicator that is being introduced by Mr. C. S. Knight, well-known in electrical circles. The sign is shown in Fig. 1 as in use at the corner of Broadway and Barclay Street, New York City. Figs. 2 and 3 show it in greater detail. In Fig. 2 it is seen in place ready for service. In Fig. 3 it is depicted as it appears when thrown up so that the arc lamp can be trimmed. The letters in the sign are of white opal glass, and are therefore legible a long way off, day or night. The structural material is sheet metal, and the whole sign does not weigh more than about 3 lbs. Such efforts as this deserve hearty encouragement, for, if reports be true, there is hardly a city in the Union where such signs, or something similar, could not be used with advantage and benefit.

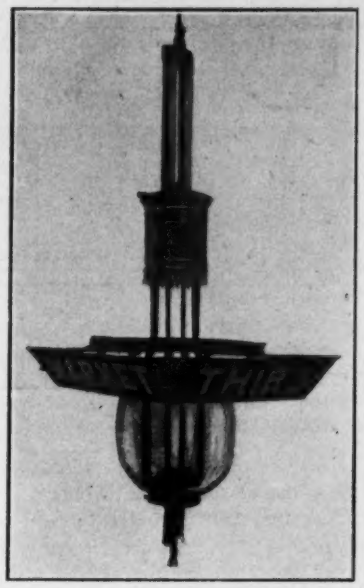


FIG. 2.—SIGN IN PLACE.

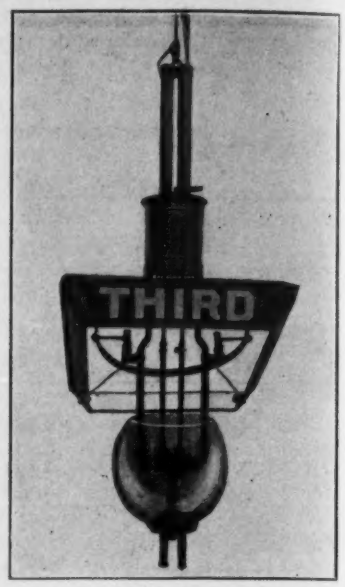


FIG. 3.—LAMP READY FOR TRIMMING.

Water-Tight Floor Outlet.

The floor outlet box shown in the accompanying illustration is specially adapted for construction work in which wires are to be brought to floor outlets for making connections for electric lights.

FLOOR OUTLET.

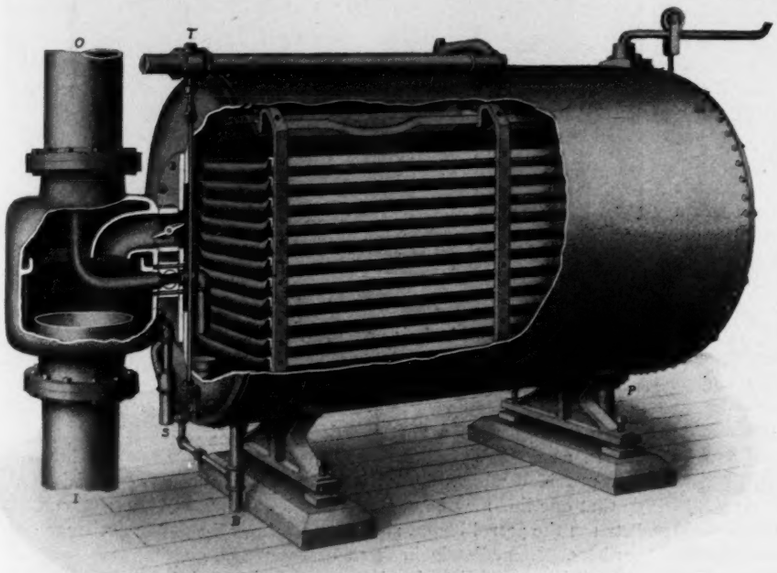
fans, push buttons or telephones on desks, tables or store counters. It has been designed especially to meet conditions where an outlet is exposed to water and dirt when floors are scrubbed and swept, or

installed in situations where it is subjected to hard usage. It is made thoroughly water and dust-proof, being provided with gaskets at the joints and leaded where screw thread connections are made. An important feature is that it is adjustable with respect to the floor level, the wiremen being enabled to place the inlet at any exact level by simply turning the top of the box. It can be applied to any use without interchange of parts, a standard socket and plug being used for connection inside of the box, it may thus be applied for making connections to electric lights, fans, push buttons or telephones. For the same reason a change of service can be readily made.

It will be noted that the flexible cord comes from the side of the outlet nozzle, thus rendering it less subject to injury. When not in use a brass plug supplied with the box may be substituted for the outlet nozzle, which will make the plug plate perfectly water-tight and flush with the floor. In installing the lower casting is set from one to one-half inch below the floor level. When conduit is run the iron collar with adjustable floor plate is not set in place until the time the floor is being laid, or after. The manufacturers, the General Incandescent Arc Light Company, New York, furnish the box with or without porcelain enamel lining inside.

Induction Chamber for Feed Water Heaters.

We illustrate a device for connecting the exhaust steam to feed-water heaters, which has for its object the reduction of cost in pipe work. The device is also an oil eliminator, both for the steam used in the heater and that which flows to the atmosphere or to be used in heating systems or for other purposes. As shown in the illustration, this device consists of an attachment at the rear end of the heater through which all of the exhaust steam is intended to flow. The exhaust passes through this device in an upward direction, and as much as is required to heat the water passes into the heater through the large curved pipe, the open end of which is in line with the flow of the steam through the chamber. The small pipe curved upwards leads from near the bottom of the heater to the upper portion of the chamber and carries the non-condensable gases and air from the heater into the main exhaust line. This produces a perfect circulation throughout the heater, and by so doing the temperature of the water flowing through is always raised to the maximum. The two



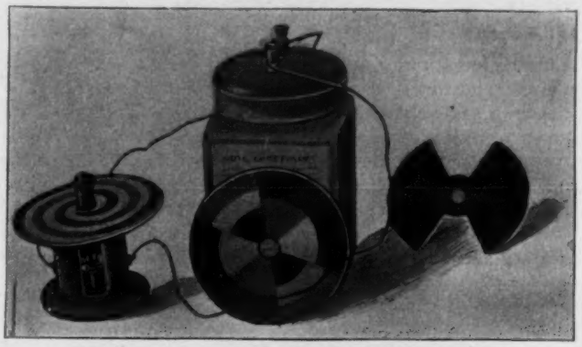
INDUCTION CHAMBER FOR FEED HEATERS.

pipe connections to the heater are provided with valves for shutting off the heater for cleaning or inspection.

From the above it would appear that this device will not only save the expense of two or three straight-way valves and a number of large fittings, but also considerable space, which is a valuable consideration, especially in steam plants of large office buildings or other places where little room is available for this purpose. This device is manufactured by the Hoppes Manufacturing Company, of Springfield, Ohio, and they have arranged by an interchangeable system of flanges to attach it to either their standard or cast iron heaters of any size.

An Electric Chromatropic Top.

One of the most interesting novelties of the holiday season is an electric top manufactured by Kendrick & Davis, Lebanon, N. H. It consists of a little electric motor, with the armature revolving horizontally on a vertical shaft. It easily operates with one cell of dry or other battery. At the top of the shaft is a grooved pulley on which is placed a card board disk lithographed in colors, which fits down tightly over the pulley. The black disk shown in the engraving is placed on top of this, fitting loosely, which permits the colored disk

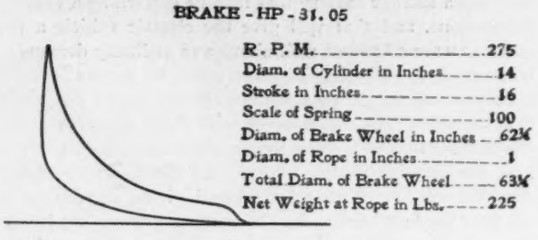


ELECTRIC TOP.

underneath to revolve with the speed of the motor while the upper disk slips just enough to make delightful color changes. The disks are lithographed with different combinations of color on each side, thus making four variations of color scheme. The motor may be used as such to operate mechanical toys, with a belt running from the pulley. The motor is finished in red enamel with polished nickel trimmings, and is placed on the market at a low price. It will be an acceptable Christmas gift to the mechanically-inclined boy, while affording pleasure and even instruction to the older members of the family.

The Mietz and Weiss Gas Engine.

The accompanying cut is a reproduction of an indicator cord from a Mietz and Weiss kerosene engine, made by August Mietz, 132 Mott Street, New York. The Mietz and Weiss engine, which is claimed to be the simplest form of heat engine made, uses either gas or ordinary kerosene (lamp oil), or even crude petroleum. A small pump controlled by a graduating charge governor forces the oil directly into the cylinder at every revolution of the crank-shaft, thus keeping a constant speed at all


BRAKE - HP - 31. 05
R. P. M. 275
Diam. of Cylinder in Inches 14
Stroke in Inches 16
Scale of Spring 100
Diam. of Brake Wheel in Inches 62¼
Diam. of Rope in Inches 1
Total Diam. of Brake Wheel 63¼
Net Weight at Rope in Lbs. 225

GAS ENGINE INDICATOR CARD.

loads, and rivaling, it is claimed, the best steam engine in regulation. An instantaneous vaporization of this oil mixing with the entering air in the cylinder completes the charge which after a compression of about 100 lbs. per square inch, is automatically fired. The type of self-ignitor is one of the notable features of the engine, as it causes even the smallest quantity of kerosene, as when the engine is running light, to explode with remarkable certainty. The accompanying diagram, which is from a 30-hp single-cylinder engine

running at 280 r. p. m., indicates the precision with which the explosions take place at light, half and full loads. The maker states that the oil consumption of this engine is 0.6 pint of kerosene per horse-power-hour. The comparative cost of running of a 30-hp Mietz and Weiss kerosene engine and an up-to-date 30-hp steam engine is given as follows:

With coal at $4 per ton, an engineer at $500 per year and $67.10 for lubrication, the total annual cost of the steam engine is $2,017.10. With kerosene at 7½ cents per gallon, attendance at $100 per year and $25.80 for lubrication, the total for the kerosene engine is $845.80.

Future Automobile Construction.

President R. Lindsay Coleman, of the American Bicycle Company, who has observed with much satisfaction the degree of public interest manifested in this year's automobile show in Madison Square Garden, said at the close of the week:

"It begins to look now as though the automobile had fairly started upon a long and sucessful run of public recognition and favor. I had anticipated a lively show this year, in which New Yorkers would exhibit marked appreciation of the many improvements made within the past 12 months, but I confess that my expectations have been exceeded to a most gratifying extent. Until recently few, if any, conscientious makers have been able to guarantee their products as embodying those features in construction and operation, which would make them safe, satisfactory and reliable. We, ourselves, with perhaps unrivaled facilities for manufacture, have been for months past engaged principally in the work of experiment and investigation, and not until now, as exemplified in the models shown here, have we been able to say that the experimental stage has been passed, and that in the steam, electric and gasoline types of our manufacture, have we finally produced machines for business, pleasure and merchandise transport purposes in which full reliance may be placed, and in which simplicity of operation and construction have been attained to a degree that we had not at first thought practicable.

"Which type do I think will become most popular? Oh, that depends upon the purpose for which the machine is desired. For business purposes, and for merchants and professional men; for comparatively short pleasure rides about the city and suburbs; and for the transfer of merchandise and the delivery of parcels and packages; in fact, for vehicles used in and about the city where recharging facilities are conveniently at hand, the electric vehicle will be most largely used. For long-distance touring purposes, however, and for track and road racing, the steam vehicle has already shown its capabilities. The gasoline motor is also better fitted for the last-named fields than is electricity.

"Perfection in the construction of steam vehicles," continued Mr. Coleman, "is a far simpler problem than that presented by the electric type. It is not, on the whole, difficult to apply the principles of steam propulsion to automobiles, and the only really puzzling questions that have delayed makers of this class of vehicles, have been those arising from the necessity for economy of space and simplicity of construction and operation. In the electric vehicle, however, the field of investigation has not been nearly so well threshed out, while the fact that power, once exhausted, can only be re-created at charging stations has stimulated inventive genius as never before, to the end of devising a storage battery that may be carried by a vehicle of ordinary proportions, and that will give the electric vehicle a touring radius and a reserve of power well above any ordinary demands that may be made upon it. If electric power could be generated as easily and as simply as can steam power, the problem would cease to exist. Until that becomes possible, makers will place a standing premium upon the battery that will store the greatest amount of power, and thereby give the greatest touring radius. In the Sperry battery, with which our Waverley machines are equipped, giving a radius of over 60 miles, we have the best battery for the purpose yet produced, but we shall not feel satisfied until we have greatly improved upon this, and perhaps have solved the problem entirely by producing a battery whose storage capacity shall be so greatly increased that long-distance work may be attempted successfully.

"As yet, motor vehicle construction is, comparatively speaking, in a primitive stage. Judging from what has been accomplished in the past two years, it is perfectly safe to anticipate improvements in the near future far greater than any yet introduced, and these improvements, you may feel assured, will be the outcome of Yankee grit and genius. The automobile is a product of old world origin, but in time America will be selling to Europe and Great Britain better motor vehicles of all types than Europe and Great Britain can turn out, just as we have sold them bicycles so far superior to those of their own make that there was no room for comparison from any essential standpoint."

The Police Telephone Signal System of the Pan-American.

One of the most interesting features of the Pan-American Exposition was the new police system that was in use throughout the Exposition grounds. The system differs materially from the circuit telegraph signaling systems that have largely been in use in the past. It was leased to the Exposition Company, and installed at its opening, and remained in service during the entire season for the Police and Guard Departments. The system was divided into three stations, in which all reports were received. Fig. 1 shows the Central Office equipment at Station No. 1, located in the Service Building. This was a board for 50 patrol box circuits, and 10 private telephone lines. These boards are provided with two sets of indicators for each line and patrol box. The regular officers' report signal is a shutter-drop, and one for each line is placed in the middle of the face of the board above the corresponding number of spring-jacks. In the center of the board are mounted the telephone line visual signals, to which are connected the private telephone lines from the commandant of police's office, the sergeant's office, and the captain's office, to the sub-stations, and also trunks to the main telephone exchange. Immediately below the visual signals, are mounted the "clearing out"

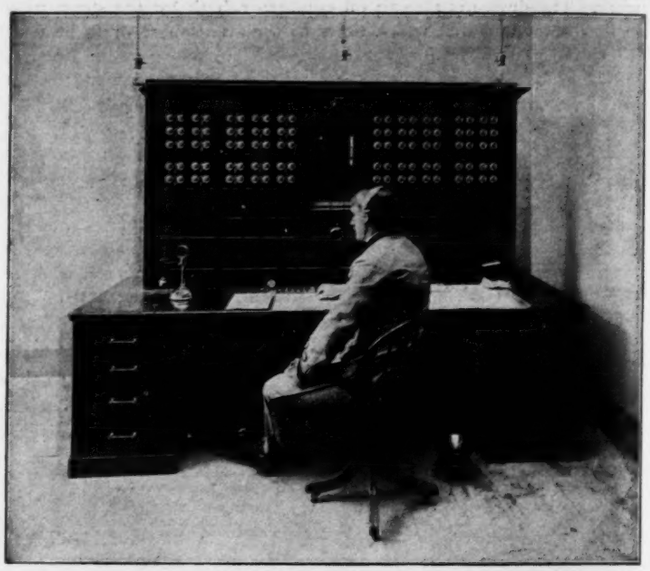


FIG. 1.—50-LINE CENTRAL STATION PATROL SWITCHBOARD.

signals. Just above the regular reporting signals, are mounted a set of polarized ringers with gongs, for the emergency or wagon call signal. Each set of bells is provided with a small numbered indicator which corresponds in number with the station calling, and indicating which bell was rung.

The board is equipped with a complete operator's telephone, and is also provided with a portable desk telephone, which may be connected as a duplicate of the regular operator's set. The board is also provided with sufficient number of connecting cords and plugs, so that one line may be connected with another, and connection made between the patrol boxes, and the offices and the public exchange subscribers. Immediately in front of the plugs, on the plug shelf, are mounted a set of listening buttons, one for each line. When an officer reports, the operator presses the corresponding number listening button, which directly throws into circuit the operator's telephone, thus avoiding the use of the connecting plugs. Provision is made for using a power-generator. A hand-generator is provided for emergency use.

Fig. 2 shows a sub-station desk switchboard in one of the tents in Guard Station No. 3. This sub-station board was an ordinary roller-top desk, and equipped for 30 patrol box circuits and 10 private telephone lines. Station No. 2, located in the Dairy Building, was provided with a main office switchboard, the same as Station No. 1. The three stations' switchboards were connected with direct-wire trunk lines, so that connection could be made from any of the patrol boxes connected with any one of the boards, direct to any of the other

stations, or any of the other station patrol boxes, as well as with the commandant's office, the other officials, and the main telephone exchange connected with Station No. 1 switchboard.

With the 50-circuit board in Station No. 1 were connected by wire 47 patrol boxes. Forty patrol boxes were connected with the 50-circuit board in Station No. 2, and 26 with the 30-circuit board in Station No. 3. All lines were run with rubber-covered braided and

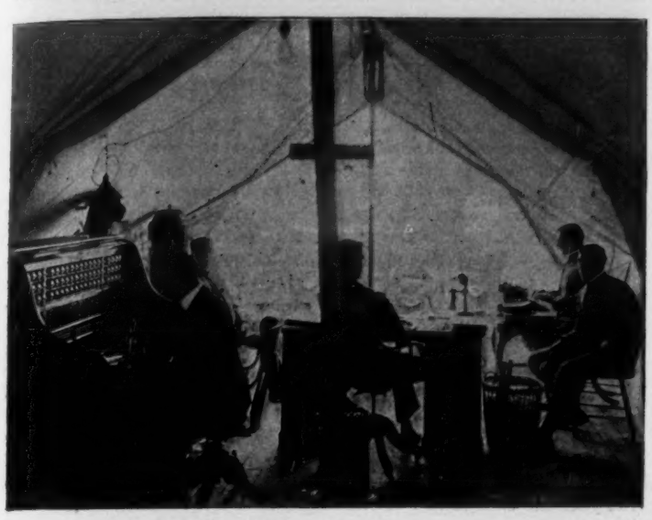


FIG. 2.—SUB-STATION PATROL BOARD IN TENT.

twisted Hazard wire. In the central part of the grounds all wires were placed in conduits.

Fig. 3 shows one of the police boxes open, and a guard giving the regular reporting signal. Taking the receiver from the hook throws the drop on the central office switchboard, which corresponds with the number of the box with which it is connected. When the signal is received, the operator presses the listening key corresponding in number, and the guard reports his name or number, of which the operator makes a record, as well as the time the report is given. A hand generator is mounted in the box, with a crank projecting through the inner door, seen in the center of the box. This generator is used as the emergency or wagon call, and when operated, rings the bell on the switchboard; and the shutter between the gongs indicates the number of the box calling. The bells in the box immediately above

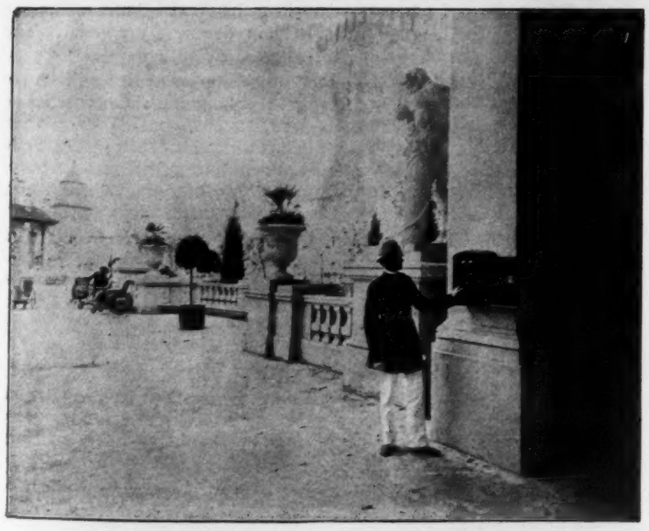


FIG. 3.—PATROL BOX OPPOSITE ELECTRICAL TOWER.

the wagon call generator, are for the answer-back signal, and are rung from the central office when a wagon call is received, to indicate to the officer that there is no trouble on the line, that the call has been received, and the wagon is being sent.

Back of these bells are a pair of heavy compound ringers, with a pair of four-inch gongs placed in the top of the box, which are used for the recall bells. The top of the box has an opening on each side for the emission of sound from the bell. These bells will ring only when the door is closed, being cut out by a spring key when the door is open. The recall bell is for calling the officers instantly to the box at any time from the central office. The recall bells on any of the boxes can be rung separately, or all in the entire district rung simultaneously.

Immediately under the wagon-call generator is mounted a long-distance transmitter, with the mouthpiece projecting through the inner door. The receiver hook is a special platinum contact gravity switch, cutting out of the circuit the entire box, excepting the recall bell, when the receiver is on the hook. The emergency call generator is provided with an automatic shunt, and cuts itself in when operated. The receiver is a strongly built, double-pole horseshoe magnet, adjustable instrument, and is provided with a special weather-proof long conductor cord. The apparatus is mounted in a heavy cast-iron weather-proof protection box of neat design, well painted with weather-proof paint, all main parts being mounted back of an inner door, excepting the receiver, which is provided with a weather-proof cord enabling the system to be used in rainy and wet weather without affecting its working parts.

Fig. 4 shows box 37 in District No. 1, at the entrance of the Temple of Music, where President McKinley was shot Sept. 6, and from which box the ambulance was called to remove him. This box was located on the outside of the building at the south entrance, where it was most convenient for emergency use, as well as for regular reporting of the guards. All the boxes on the grounds were placed in the most prominent and convenient places, and it is said that the

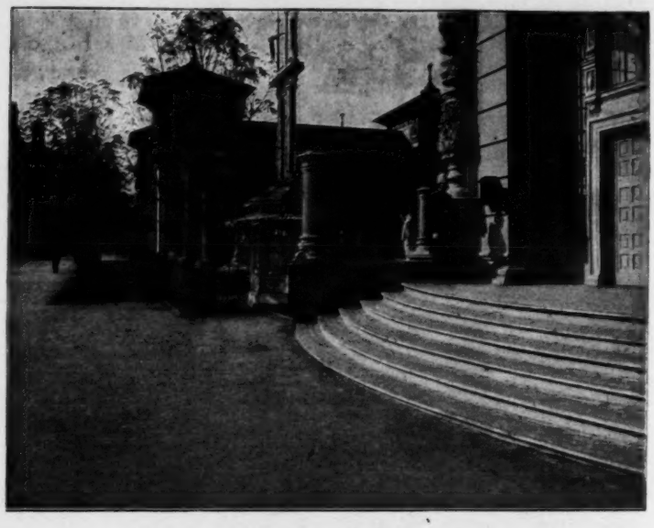


FIG. 4.—PATROL BOX AT TEMPLE OF MUSIC.

system was one of the most important and satisfactory features for the protection of the Exposition. This system, above noted, is that of the Municipal Signal Company, of Chicago, Ill., as invented some years ago by N. Banks Cregier, of that city. It has, of course, been considerably elaborated and improved in the past decade.

New-Angle Boring Bit Stock.

ANGLE BIT STOCK.

The Smith & Hemenway Company and the Utica Drop Forge & Tool Company, of 296 Broadway, New York City, are introducing the 1901 model of their new angular bit. It is adapted for use in connection with any bit or boring machine, also for reaming holes, turning screws, nuts, etc., in angles heretofore impossible. The chuck part of the machine bends as far as the dotted lines shown in the cut, and is locked firmly with the set pin at any angle desired. The gearings are turned out of the finest bar steel with cut teeth, and the shaftings and side plates are of the finest Bessemer stock. All parts are turned and fitted to run perfectly true. A few of the uses to which it can be put are boring against partitions, alongside the wall, between beams, around projections, shelves and in close, straight angles.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Realizing sales and declines followed the announcement of the terms of the Northern Pacific settlement. The bearish tendency was also aided by large gold shipments and fears regarding money, but there was a general recovery late in the week on the expectation of a satisfactory bank statement. Traction stocks were quite active. There were alternations of pressure and support in Metropolitan and Brooklyn Rapid Transit was apparently cared for by a pool in the stock. All through the week there were rumors in a variety of forms regarding traction consolidations in Greater New York, but these were diligently denied by the officials of the companies concerned. The effect was exhilarating on Metropolitan and Brooklyn Rapid stocks. There was great activity in trading in both stocks, 157,810 shares of the former and 150,400 of the latter having changed hands. Metropolitan ranged between 163 and 169¾, closing at 167¾, a net gain of 5⅞ points, and Brooklyn Rapid Transit, after fluctuating between 66⅞ and 71, closed at 68⅝, a net gain of 1¼ points. General Electric was quiet, ranging between 256 and 259, closing at a figure one point below the highest, and making a net gain of 1½ points. Western Union showed some activity, the sales aggregating 42,800 shares, the range of prices being 89⅞ and 92½, closing at 90⅛, showing a net loss of 2½ points. American District Telegraph made a net gain of ¼ point. Call money is quoted at 4¼ per cent, nominal, and 4½ for high grade time loans. Following are the closing quotations of Nov. 19:

NEW YORK.

	Nov. 12.	Nov. 19.		Nov. 12.	Nov. 19.
American Tel. & Cable	100	96	General Electric	259	257⅛
American Dist. Tel.	—	36	General Carriage	¾	¾
Brooklyn Rapid Transit	68¼	68¼	Hudson River Tel.	110	110
Ches. & Pot. Telephone	67½	—	Illinois Elec. Veh. Trans.	—	—
Commercial Cable	—	170	Metropolitan Street Ry.	166¼	168¾
Electric Boat	18	17	N. E. Elec. Veh. Tran.	—	—
Electric Boat pfd.	40	40	N. Y. Elec. Veh. Tran.	6¼	5⅜
Electric Lead Reduc'n	2	1⅞	N. Y. & N. J. Tel.	166	166
Electric Vehicle	2	2¼	Tel. & Tel. Co. of Am.	—	—
Electric Vehicle pfd.	4½	4½	Western Union Tel.	92½	90⅝

BOSTON.

	Nov. 12.	Nov. 19.		Nov. 12.	Nov. 19.
Am. Tel. & Tel.	157	157	Mexican Telephone	2¼	2
Cumberland Telephone	—	—	New England Telephone.	—	132
Boston Electric Light	—	—	Westinghouse Elec.	—	70
Erie Telephone	22	21¼	Westinghouse Elec. pfd.	—	—
General Electric pfd.	—	—			

PHILADELPHIA.

	Nov. 12.	Nov. 19.		Nov. 12.	Nov. 19.
American Railways	42	44½	Phila. Traction	95⅞	97⅛
Electric Storage Battery.	55	57	Philadelphia Electric	5¼	5
Elec. Storage Batt'y pfd.	55	57	Pa. Electric Vehicle	¾	¾
Elec. Co. of America	6⅝	6⅞	Pa. Elec. Veh. pfd.	1	1

CHICAGO.

	Nov. 12.	Nov. 19.		Nov. 12.	Nov. 19.
Central Union Telephone	—	40	National Carbon pfd.	82½	84
Chicago Edison	158	—	Northwest Elev. com.	40	39
Chicago City Ry.	195	188	Union Traction	12¾	12⅞
Chicago Telep. Co.	225	—	Union Traction pfd.	50	52½
National Carbon	20¼	20			

PITTSBURG TROLLEYS.—The board of directors of the Philadelphia Company, of Pittsburg, has completed arrangements to increase its bonded indebtedness to $22,000,000 and the capital stock to $36,000,000. The Southern Traction Company is to be absorbed, the stock issue of which amounts to $5,000,000. Negotiations are pending for the absorption of the Suburban Rapid Transit Company and other smaller interests, which, when completed, will give the Philadelphia Company entire control of traction operations in the Pittsburg district. A report of a committee of the Philadelphia Company directors will be presented to the stockholders of the Philadelphia Company for their approval on Dec. 4, when the committee, which is arranging for the absorption of the outside interest, will be ready with its report. The present bonded debt of the Philadelphia Company is $6,500,000. Of the proposed new $22,000,000 bond issue, the $6,500,000, to cover the old issue, will be reserved to take up the outstanding bonds when they mature. Of the rest $12,000,000 will be available to exchange as part payment for $12,000,000 preferred stock of the Consolidated Traction Company, if this amount is turned in under the proposition of the Philadelphia Company. The remaining $3,500,000 bonds will be directly available to provide funds for the betterment and extension of the properties of the companies. The entire issue of $5,000,000 stock of the Southern Traction Company is to be transferred for $2,500,000 of the common stock of the Philadelphia Company. This will be done by an exchange of one $50 share of Philadelphia common for one $50 preferred and one $50 common share of the Southern stock. Owners of this stock of the Southern Company have agreed to the sale on this basis.

CONSOLIDATING NEW ENGLAND TROLLEYS.—A consolidation of the Newton, Newton & Boston, Wellesley & Boston, Commonwealth and Lexington & Boston Street Railway companies has been effected under the title of the Boston Suburban Electric Railway Company, with a capital of $6,000,000 equally divided between common and preferred stock. The company will operate 66 miles of road. Of the $6,000,000 stock a large portion will remain in the treasury to provide for future extensions. The stock issued has all been taken in exchange for stock of the five controlled roads. The consolidation is formed after the manner of the Massachusetts Electric Companies—a voluntary association—and the following board of trustees elected: Leonard D. Ahl, Adams D. Claflin, Winthrop Coffin, William H. Coolidge, William F. Hammett, Sydney Harwood, Frederick H. Lewis, Horace B. Parker, Alfred Pierce, Frank W. Remick, James L. Richards, Charles W. Smith, George W. Morse, R. Elmer Townsend, Alden E. Viles. The securities of this association will be listed upon the Boston Stock Exchange.

MANHATTAN ELEVATED shows $10,455,872 gross for 1901 and net just half. The passengers carried were 194,152,316, a gain of 10,363,465. At the annual meeting, President Gould said: "During the year the change to electrical equipment has made great progress. The buildings for central power station at East Seventy-fourth Street, and sub-stations at Allen Street, Thirty-fourth Street, and Ninety-ninth Street are completed, and the machinery is being rapidly installed in all of them. Motor equipments are arriving in quantity, and deliveries of 300 new cars will commence within two weeks. Our engineers expect to turn the first 8000-hp engine and dynamo by Dec. 1, and run the first trains on Second Avenue during the month, to be followed up as rapidly as the equipment can be assembled and put in operation."

ELECTRIC VEHICLE BONDS.—The bondholders of the Electric Vehicle Company have voted to change the agreement under which the bonds were issued, to meet the conditions that have developed by the business so as to release a certain amount of securities and cash for working capital. The amount which will be realized in this way is not stated. There are $1,675,000 of bonds. The mortgage under which these bonds were issued is dated May 1, 1901. The head offices of the company have been removed to Hartford, Conn. Electric Vehicle does not lease vehicles any more, but sells them outright. The outlook for business is said to be good. Automobiles are in growing demand, and electrics remain deservedly popular. The company has also good gasoline vehicles.

RAILWAY MORTGAGE.—The following securities will be retired when the new $35,000,000 blanket mortgage on the properties of the Detroit District Railways is issued: Detroit Citizens' bonds, $7,000,000; Detroit Railway bonds, $2,800,000; Ft. Wayne & Belle Isle bonds, $1,200,000; Pontiac & Binghamton bonds, $1,100,000; Detroit & Northwestern bonds, $855,000; Detroit & Romeo bonds, $2,500,000; Detroit & Wyandotte bonds, $425,000. Total, $15,880,000.

DIVIDENDS.—The American Railways Company has declared a quarterly dividend of 1¼ per cent, an advance of ¼ per cent over the regular rate, payable Dec. 15. The earnings statement laid before the board showed about $75,000 net earnings for the quarter ended Sept. 30, 1901, or equal to 8 per cent per annum on the $3,750,000 capital stock.

WESTERN UNION was weak last week. The break was said to be due to pool selling. To explain it, the reason was offered that the contract with the Pennsylvania Railroad just renewed is much less satisfactory than the one that formerly obtained, while there was talk also of competition in the South by a new company.

CHICAGO ELEVATED.—The statement is made that arrangements will be made about the end of this month for the sale of an additional $5,000,000 4 per cent bonds of the Northwestern Elevated of Chicago, making the $15,000,000 to be issued out of the $25,000,000 authorized when the purchase of the Union Loop was completed.

NASHVILLE, TENN., TROLLEYS.—The Nashville Street Railway will be sold under foreclosure proceedings, and C. K. C. Billings will acquire the property, said to be worth about $7,000,000. He owns the Memphis Street Railway.

TELEPHONE MORTGAGE.—The United States Telephone Company has filed a $1,000,000 mortgage in favor of the Cleveland Trust Company covering all its property, which represents one of the largest interests in the independent telephone field.

PHILADELPHIA UNION TRACTION.—An official of the Union Traction Company, of Philadelphia, is given as authority for the statement sent from that city that there will soon be an assessment of $5 a share on the stock, payable in two installments, and that there will be no dividend at present.

WEST END STREET RAILWAY.—The Massachusetts railroad commissioners have received a petition from the West End Street Railway Company, asking for the approval of an issuance of 4 per cent bonds due 1915 to the amount of $1,800,000 for improvement of the company's property required under the lease to the Boston Elevated.

Commercial Intelligence.

WEEK IN TRADE.—The reports received by the commercial agencies during the past week are even more encouraging than they have been in the recent past. The favorable features are still largely in the ascendant, and the current of business is running free the country through. The iron and steel situation has gained rather than lost in activity and strength, and production and consumption at present find no parallel in the past. The demand is heavy. The rail situation is one of special strength, the leading interest being reported as having booked its output for the entire year of 1902. The shortage of cars restricted furnace operations in the Central West and complaints from all of the heavy buyers are heard in addition. The railroad earnings reports confirm the more sanguine predictions of good business enjoyed by the transportation interests. For the month of October they were 11.3 per cent greater than in October last year, and 21.2 per cent over the same month in 1899, while those roads reporting for the first week of November show an average gain of 9.8. The business failures, as reported by *Bradstreet's*, aggregated 213, against 191 the week previous, and 227 the corresponding week last year. The copper market continues quiet and steady without any special feature, and there seems to be a disposition on the part of consumers to operate somewhat more freely. A cut in the price of copper wire has been reported. Quotations are unchanged at 16⅝@16¾c. for Lake, 16¼c. for electrolytic in cakes, wire bars and ingots, 16c. for cathodes and 15⅞@16c. for casting copper.

IMPORTS OF MANUFACTURED MATERIAL.—A detailed examination of imports of manufacturers' material in the first nine months of 1901 shows a large increase. While the total imports of manufacturers' material in the nine months ending with September, 1901, exceed in value by $4,000,000 those of the corresponding nine months of 1900, the actual increase in quantity is probably considerably greater than that indicated by the statements of values simply. This is due to the fact that there has been during the last year a marked decrease in the prices of the principal articles imported for use in manufacturing, and, therefore, while the figures of value show a material increase, those of quantity show an even greater increase. The importations of manufacturers' material are largely made up of six great articles—india rubber, silk, fibers, hides and skins, tin for use in manufacturing tin plate, and chemicals for use in the manufacturing industries. In nearly all of these the prices per unit of quantity in 1901 are less than those of 1900. In raw silk, for instance, the value of the importations of the nine months ending with September, 1901, is $26,377,699, against $26,256,077 in the corresponding months of last year, the increase in value being very slight; but the number of pounds imported in the nine months ending with September, 1901, is 8,404,824, against 6,561,880 in the corresponding months of last year, an increase of about 30 per cent in the quantity imported. In fibers the figures of value show a slight decrease, while the quantity shows an increase, the value being in the nine months ending with September, 1901, $19,259,909, against $21,351,842 in the corresponding months of last year, a slight decrease, while the quantity in 1901 is 199,832 tons, against 187,976 tons in the corresponding months of last, a material increase in quantity. In crude rubber this is also true. The value of rubber importations in the nine months of 1901 is $20,869,070, against $21,449,246 in the same months of last year, a slight decrease in value, while the quantity imported in 1901 is 40,481,040 lbs., against 34,493,337 lbs. in the same months of last year, an increase of more than 15 per cent. In pig tin the same improvement in price is noted, the value of the imports in 1901 being $14,679,768, against $15,281,577 in the corresponding months of last year, while the quantity in 1901, 56,308,901 lbs., against 54,847,417 lbs. in the corresponding months of last year.

EXPORTS OF ELECTRICAL MATERIAL AND MACHINERY.—The following are the exports of electrical material, machinery, etc., from the port of New York for the week ended Nov. 9: Antwerp—Materials, 26 pkgs., $1,838; machinery, 8 pkgs., $800. Amsterdam—Material, 1 pkg., $12. Argentine Republic—Material, 125 pkgs., $3,381. British East Indies—Material, 9 pkgs., $225; machinery, 28 pkgs., $2,200. Bristol—Machinery, 44 pkgs., $14,442. Brussels—Material, 3 pkgs., $200. Bremen—Material, 3 pkgs., $108. British Guiana—Material, 52 pkgs., $2,930. Barcelona—Material, 14 pkgs., $500. British West Indies—Material, 117, $2,443. Cuba—Material, 108 pkgs., $2,298. Central America—Material, 2 pkgs., $90. China—Material, 2 pkgs., $70. Chili—Material, 46 pkgs., $2,245. Copenhagen—Material, 2 pkgs., $550. Chemnitz—Machinery, 1 pkgs., $700. Dutch West Indies—Material, 2 pkgs., $30. Glasgow—Machinery, 26 pkgs., $1,595; machinery, 64 pkgs., $2,610. Hamburg—Machinery, 82 pkgs., $1,252. Hong Kong—Machinery, 73 pkgs., $3,489. Havre—Machinery, 9 pkgs., $115; material, 7 pkgs., $418. Japan—Material, 134 pkgs., $31,197; machinery, 100 pkgs., $17,967. Liverpool—Machinery, 6 pkgs., $450. Lyons—Machinery, 1 pkg., $150. London—Material, 33 pkgs., $1,793; material, 80 pkgs., $4,043. Mexico—Material, 79 pkgs., $1,845; machinery, 42 pkgs., $1,606. New Zealand—Material, 72 pkgs., $2,112; machinery, 2 pkgs., $239. Nice—Machinery, 5 pkgs., $200. New Castle—Machinery, 29 pkgs., $2,500. Philippines—Material, 23 pkgs., $950; machinery, 74 pkgs., $5,560. Peru—Material, 15 pkgs., $236. South Hampton—Material, 4 pkgs., $239; material, 103 pkgs., $732; machinery, 2 pkgs., $275. U. S. Colombia—Machinery, 4 pkgs. $191; material, 13 pkgs., $359. Venezuela—Machinery, 3 pkgs., $44.

THE COPPER SUPPLY.—Returns of the stock of copper in and afloat for Europe Oct. 31 show large reductions during the past month. The visible European supply is 20,965 tons, against 24,765 on Sept. 30, a decrease of 3,800 tons. European stocks of copper compare as follows for a series of months:

	Tons.		Tons.
Nov. 1, 1901	20,965	Nov. 1, 1900	28,812
Oct. 1, 1901	24,765	Nov. 1, 1899	26,847
Sept. 1, 1901	25,811	Nov. 1, 1898	25,798
July 1, 1901	27,461	Nov. 1, 1897	34,389
April 1, 1901	28,236	Nov. 1, 1896	35,779
Jan. 1, 1901	28,921	Nov. 1, 1895	50,383

The highest level reached by European supplies in the recent "boom" was 30,215 tons, on Sept. 1, 1900, but the amount has been much larger at other periods. On July 31, 1897, it reached 34,004 tons; on June 30, 1895, it rose to 58,182 tons; on Jan. 31, 1890, to 95,714 tons; and on July 31, 1888, when the Secretan syndicate was in active operation, the very large amount of 118,116 tons was reached by European supplies. The present foreign stock is smaller than that of any month in at least sixteen years. It is alleged that production is being kept down by large miners, in order to maintain present prices.

THE DEMERARA ELECTRIC COMPANY, LIMITED, of Georgetown, British Guiana, in which Sir William Van Horne, late president of the Canadian Pacific Railway, is largely interested, and of which H. P. Bruce, formerly of the Consolidated Traction Company, of Pittsburg, is general manager, is reported to be placing some substantial contracts for general electrical supplies in the United States. The Morris Electric Co., of 15 Cortlandt Street, New York, is reported to have secured a $5,000 order for miscellaneous supplies by last mail. Further contracts are expected to be placed with American manufacturers very shortly, as advices have been received from Georgetown that the local gas company has ceased to exist on account of the competition of the electric company, and that a considerable lot of work is in hand for additional city lighting and private customers with a view to the replacing of gas by electric light.

TRAMWAYS IN MEXICO.—The Compania Limitada de Tranvias Electricos de Mexico, of the City of Mexico, is reported to have just forwarded a substantial contract to the Morris Electric Company, calling for the shipment of stock supplies sufficient for the next six months. The order embraces 10,000 incandescent lamps of 16 candle-power, track bolts, linen tape, linen, mica, magnet wire, asbestos, wire nails, air hose, switches, etc. A large portion of the contract, which in all is said to be valued at over $20,000, will be sub-let.

BALL ENGINE CONTRACTS.—The Ball Engine Company, Erie, Pa., will furnish three tandem compound engines arranged for direct connection to Westinghouse generators, for the Pennsylvania Railroad Company's Arcade Building, Philadelphia, Pa. The Bisbee Improvement Company, of Bisbee, Mont., has recently ordered a compound direct-connected engine from the Ball Engine Company for its electric plant. M. R. Williams & Co., of Piedmont, N. Y., have recently installed an engine built by the Ball Company.

EQUIPPING STEEL WORKS.—It is reported that the Westinghouse Electric & Manufacturing Company, of England, has received a very large contract from Bolckow, Vaughn & Co., Limited, of England, for electrical equipment. The Westinghouse people have already done some heavy work in England in steel plants.

SWITCHBOARD FOR P. R. R.—The Walker Electric Company, registered, Philadelphia, Pa., has secured the contract from the Pennsylvania Railroad for the main switchboard in the new Union Station at Pittsburg.

HENRY TRAIN-LIGHTING SYSTEM.—The Henry Electric Equipment Company has been formed at Denver, Colo., with a capital stock of $1,000,000. The president is Mr. C. F. Elliott, former traffic manager of the Florence & Cripple Creek Railroad. Mr. J. H. Peabody, president of the First National Bank, of Canon City, is treasurer. Mr. D. Carl Henry, of Denver, is secretary and chief electrician. Successful trials have been made of the system to be exploited. The object of the company is to manufacture and sell electric train lighting equipment, for Pullman cars. The device is now in practical operation at the company's shops. It is the intention of the company to erect a large factory in Denver, and to equip cars with the system, consisting of a direct-connected generator, mounted on the axle of the train, in combination with storage battery and other devices, the invention of Mr. John C. Henry, who died in Denver last spring, and who was one of the original inventors of the modern electric railway. Improvements on the inventions have been made since the death of the inventor by his son, D. Carl Henry. The company owns three United States patents, with a number of others pending. The stock is held by Denver, Canon City, Omaha and Colorado Spring people, a controlling interest, however, being held by the incorporators. About $250,000 will be expended in Denver, it is said, for the erection of a factory, and the manufacture of the apparatus. It is the intention of the company to equip as many as possible of the Western railways with electric lights, electric fans, and a branch of the company will place electric refrigeration apparatus on all fruit and meat cars, doing away with ice. In addition to the Pullman cars to be equipped by the company there will be electric heaters, instead of steam, electric stoves in the diners, electric fans, and electric curling irons in the ladies' dressing room. Besides electric fans in various parts of the cars, the cars will be heated in winter by electricity and cooled in summer by the same power.

REPRESENTATION OF FOREIGN INTERESTS.—The Goudey-McLean Company, of 88 Maiden Lane, New York City, recently established with a view of acting as managers for foreign sales of a syndicate of manufacturers of electrical apparatus and fittings, has just entered into contracts for that purpose. Among the manufacturing concerns referred to are the Milwaukee Electric Company, of Milwaukee, Wis.; the Browning Manufacturing Company, makers of dynamos up to 7½ horse-power, of the same Western city; the Fostoria Incandescent Lamp Company, of Fostoria, Ohio; the Electric Motor & Equipment Company, of Newark, N. J., manufacturers of Deshler-McAllister photometers and Brewster sign receptacles; the Keystone Electrical Instrument Company, of Philadelphia; the Pittsburgh Transformer Company, of Pittsburg, Pa., and the Wheeler Reflector Company, of Boston, Mass. Mr. Edward E. Goudey, who was formerly manager of the foreign department of the Wagner Electric Manufacturing Company, of St. Louis, Mo., is secretary of the Goudey-McLean Company. He is now in Europe for the purpose of appointing agents in the principal electrical centers in Great Britain and the Continent, and will be abroad for nearly three months. Mr. James W. Boyle, late of the Wagner Company, is also connected with the Maiden Lane concern.

UNITED STATES CARBON COMPANY'S AFFAIRS.—The plant and business of the United States Carbon Company, of Cleveland, which was placed in the hands of a receiver some months ago, was sold a few days ago for $87,000 by the receiver, W. D. Sayle, to Frank Masten, as trustee. The creditors have formed a new company with Mr. Masten as trustee, and the company will be chartered in New Jersey. The plant which has been running as usual is now under the management of B. P. Foster. The company expects to enlarge the plant and double the present amount of business. In addition to the production of arc carbons, it is the intention to branch into the manufacture of battery carbons and special electrical apparatus. A new brick building 50 by 100 ft. and two stories high, to cost $50,000, is about being started. It is being erected principally for the specialty work. The company hopes to have it completed and in operation by Jan. 1.

CANAL LIGHTING IN CANADA.—The General Incandescent Arc Light Company, of New York City, is naturally proud of the excellent piece of work just done in lighting the Cornwall (Canada) Canal, for which it supplied the entire outfit of 275 series alternating current enclosed arc lamps, with regulators and switchboards. A contract for this work was placed by the Department of Railways and Canals, with Mr. M. P. Davis, of Ottawa, who has installed a fine water power plant, with turbines from Hamilton Co., of Peterboro, equipped with Lombard governors, and Bullock generators. Current at 2200 volts is raised to 11,000 for the line and then lowered to 220 for use in the G. I. lamps of 2000 candle-power each, the net cost of operation being figured at $32 per lamp per year. The lights are very successful, and extensions seem to be in order, increasing the capacity of the plant from 1000 to 4000 horse-power, there being a big call for current.

AMERICAN TRADE PRESS ASSOCIATION held its annual meeting and dinner at the Hardware Club, New York City, on November 14. An unusually large number of technical and trade papers were represented. Papers were read on the function of such journals by Mr. Franklin Ford, the economist, and by Mr. E. C. Brown, on the general aspects of trade paper advertising. Comptroller Coler took an effective part in the discussions. The association was reported in flourishing condition as to finances, membership and influence. The following ticket was elected for 1901-2: President, F. P. Burt, *Engineering News;* first vice-president, J. M. Wakeman, ELECTRICAL WORLD AND ENGINEER; second vice-president, C. R. Clifford, *The Upholsterer;* third vice-president, J. D. Crary, *New York Lumber Trade Journal;* secretary-treasurer, E. C. Brown, *Progressive Age;* director for four years, F. F. Cutler, *Shoe and Leather Reporter;* director for two years, J. H. McGraw, *Street Railway Journal.*

ELECTRICITY IN ECUADOR.—The Consul-General of the United States at Guayaquil reports that that city has recently granted a syndicate a charter authorizing the construction of an electric tramway system. The charter permits the use of any of the streets of the city (whose inhabitants now number about 50,000), and also authorizes the use of electricity for lighting and power. It also provides for the construction of a new race course, including a bicycle track in the suburbs. The concession is for 35 years, the tramway and race course reverting to the city at the close of that period. At present Guayaquil tramways are operated by mule power. They have paid an annual dividend of 25 per cent for several years. The principal streets are lighted by gas lamps and the side streets by kerosene lamps. The new company is seeking capital in the United States.

THE AMERICAN BRIDGE COMPANY, of New York, is about to make shipment from its Pencoyd works of about 500 tons of structural material, which is intended to be utilized in the construction of the new Bank of Australasia building at Sydney, New South Wales. A shipment of 250 tons of railroad bridge material has just been forwarded from the Pennsylvania plant to the same Antipodean port. The American Bridge Company has also obtained a contract for the construction of 20 steel bridges along the line of the Uganda Railroad in East Africa. The amount of the contract is about $1,000,000. Several English and Continental firms offered bids, but that of the Philadelphia company was not only the lowest, but guaranteed the completion of the work in a shorter space of time than its competitors. The new bridges will replace wooden structures, which were built several months ago and found to be inadequate.

WESTINGHOUSE EQUIPMENT FOR DE BEERS MINES.—The De Beers Consolidated Diamond Mines of Kimberley, South Africa, are to be equipped with some $135,000 worth of electrical machinery, which is to be manufactured at the Westinghouse plants, East Pittsburg. One contract calls for the shipment of two Westinghouse-Parsons steam turbines, having a capacity of 1000 kilowatts each. This contract, which is the first export order received for Westinghouse-Parsons turbines, was secured through Westinghouse, Church, Kerr & Co. Another contract requisitioned for the supply of two alternating-current direct-connected generators. This order was received by the Westinghouse Electric & Manufacturing Company. The equipment will be utilized for general power purposes in the De Beers mines.

PLANTS FOR NEW JERSEY MANUFACTURING CONCERNS.—The Edward P. Hampson Company, Havemeyer Building, 26 Cortlandt Street, has secured a contract from the Hillson Cigar Company, for the electric light and power plant, which is to be installed in its new plant about to be constructed at Elizabeth, N. J. The contract, valued at about $8,000, calls for engine and boiler to be built by the Atlas Engineering Works, of Indianapolis, while the generator will be manufactured by the General Electric Company. The Hampson people have also received a contract from the American Sanitary Company, of Elizabeth, N. J., for an electric light and power plant to include a 200-hp boiler and a 150-hp engine, both of Atlas build. The electrical portion of the plant will be manufactured by the General Electric Company and the C & C Electric Company.

TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has been very busy on power work of various kinds. It is now finishing up a large equipment of generators, motors, etc., for the new Globe-Wernicke bookcase factory, and has now in hand another similarly extensive contract for the Krell French Piano Company, of Springfield, Ohio. The plant in the latter instance will consist of a generator and some 56 motors, which will be used in various parts of the factory in driving the different tools employed in the manufacture of pianos. Some will be back geared, some operated vertically, and others direct connected. It will make one of the most important installations of the kind in the country.

ORDERS FOR WESTINGHOUSE EQUIPMENT.—Westinghouse, Church, Kerr & Co., of New York City, have secured an order for a 300-hp vertical cross-compound engine, which is to be utilized for electrical power purposes in the plant of the Dominion Bridge Company, Montreal, Canada. A contract calling for ten 25-hp direct-connected lighting sets has just been received from the Pullman Palace Car Company for use in its cars.

General News.

THE TELEPHONE.

MONTGOMERY, ALA.—The American Telephone & Telegraph Company has been incorporated with a capital stock of $250,000. Percy T. Wilden and Guy M. Lovejoy, of Bessemer and Jos. J. Dixon, of Birmingham, are among the incorporators.

SANTA MARIA, CALIF.—A telephone line is being constructed from Santa Maria to Carey, a small town ten miles up the valley.

SAN FRANCISCO, CALIF.—The Wheatville Telephone Company was recently incorporated, with Caruthers, Fresno County, Calif., as the principal place of business. Directors: F. M. Miller, H. A. Monson, W. G. Grove, J. W. Downing and H. A. Adams. Capital stock, $5,000; subscribed, $2,014.

JACKSONVILLE, FLA.—The Florida Long Distance Telephone Company will be incorporated. Charles F. Speed is president; W. N. Shine, vice-president, and C. J. M. Shine, secretary.

ATLANTA, GA.—The purchasing department of the Southern Bell Telephone & Telegraph Company, heretofore located at New York, has been moved to Atlanta, and M. O. Jackson, head of the department, together with a large force of clerks, have arrived from New York.

JACKSONVILLE, ILL.—The Illinois Telephone Company has moved its headquarters from Bluffs to Jacksonville.

MURPHYSBORO, ILL.—The American Telephone & Telegraph Company will ask for a franchise to establish a long distance telephone service in this city.

MT. VERNON, ILL.—Talbot & Frost, of Dix, were granted a city franchise for a long-distance telephone line to be constructed through Mount Vernon to Central and thence to Carlyle.

CARBONDALE, ILL.—The County Board of Supervisors has granted a franchise for a telephone system to the Farmers' Economic Union, including the use of all public highways of the county.

CHICAGO, ILL.—The rooms of the Auditorium and Great Northern hotels are being put on a branch exchange of the Chicago Telephone Company. There are 450 telephones in the Great Northern and 1059 in the Auditorium and Auditorium Annex.

SAYBROOK, ILL.—The telephone system here, owned by Mr. A. T. Wood, extends into the country among the farmers. There are 57 telephones in the village and 110 in the country, and the number of subscribers in both sections are being rapidly increased. The farmers own and control their lines, paying Mr. Wood a certain amount per year for exchange services.

CHICAGO, ILL.—Chas. H. Beers, as a minority stockholder of the Central Union Telephone Company, has petitioned the court for a receiver for that company to have the rights of the minority stockholders adjudicated. He charges that contracts have been entered into with the American Telephone & Telegraph Company, whereby exorbitant instrument rentals are paid by the Central Union Telephone Company.

INDIANAPOLIS, IND.—The Brown's Chapel Telephone Company, of Brown's Chapel Schoolhouse, has been incorporated. The directors are Eli Parish, L. C. Crider and C. E. Sipe.

SEYMOUR, IND.—Right of way has been granted Charles Leininger for the construction of a telephone line from Seymour to Crothersville. The line will be an extension of the Leininger system of this place.

LIBERTY, IND.—The Bell Telephone Company has been granted a franchise to put in an exchange here. Announcement has been made by the company that party lines will be put in along the principal highways of Union County and the service extended to any community of farm residences.

SOUTHPORT, IND.—Party line telephone service is in disfavor here. Some time ago the farmers and business men of this community constructed a party line system. Some of the farmers' wives are prone to gossip about their neighbors, and a particular slanderous conversation was listened to by the women talked about. They told their husbands, and the result is half a dozen families have become entangled in a row likely to go to the court for settlement in damages. Others threaten to have their telephones taken out, and it is likely the company will disband.

INDIANAPOLIS, IND.—The New Telephone Company has spent $37,000 for new copper wire on old lines within forty miles of this city. It built a new line to Spencer to connect with the coal fields of Southern Indiana, and is now constructing a line from this city to Terre Haute. The company is also preparing to build lines from Kokomo to Logansport, from Kokomo to Peru and from Peru to Wabash. Material is purchased to extend the line from Columbus to Louisville, Ky., to connect with the new independent plant in that city. The company says it is adding 100 telephones a month and has upwards of 5500 telephones in use in Indianapolis. Sub-stations are to be constructed, the materials for which will cost $97,000, to take care of the business on the outskirts of the city.

ELWOOD, IND.—The City Council, after considering the proposition for almost a year, has granted a franchise to George W. Beers and associates of the Anderson Telephone Company to establish and operate a telephone system in this city. By the terms of the franchise the company is to furnish a single line for each patron, doing away entirely with the party lines, and make a maximum charge of $1.50 and $2.50 a month for residences and business houses respectively. Long-distance communication with all cities and towns in Madison County is to be furnished at a rate not to exceed 10 cents for a five-minute conversation. The Beers Company has filed a written acceptance of the franchise, and will begin work at once, agreeing to have the exchange and city lines completed in four months.

INDIANAPOLIS, IND.—The New Telephone Company has arranged to give its long-distance operators lessons in elocution and distinct enunciation at the expense of the company. As far as known here this is an entirely new departure in the telephone world. The company's manager says that its long-distance patronage is such that the greatest efficiency and expedition is necessary to take care of the business. One-fourth of the calls for long-distance service have to be refused for want of time and capacity and the loss of a few minutes each hour amounts to something. A long-distance operator has considerable conversation in making appointments, etc., and frequently is asked to take the place of inexperienced patrons and do the talking for them. A clear, distinct enunciation is a valuable acquirement, while a poor speaking operator can lose much time and money for the company.

NEW HAMPTON, IA.—A company is being organized in Greene County to be known as the Greene County Farmers' Telephone Company.

SHELL ROCK, IA.—H. E. Eckles, of Tama County, has made arrangements for the purchase of the lines of the Cedar Valley Telephone Company at this place and he will improve and extend the system.

TINGLEY, IA.—The Tingley & Mount Ayr Telephone Company, capital stock $1,540, has been incorporated by D. C. Tidrick, president; R. H. Morey, secretary, and Wm. Fife, treasurer.

DOWNS, KAN.—Between twenty and thirty farmers in Corinth and Bloom townships are having a rural telephone system constructed.

LOUISVILLE, KY.—The linemen who are building the plant of the Home Telephone Company have struck for a nine-hour day and 25 cents increase in wages.

JEFFERSONVILLE, KY.—The Cumberland Telephone & Telegraph Company is negotiating for a lot on Spring Street with a view to putting up a building for an exchange.

ELKTON, MD.—The Diamond State Telephone Company is completing the construction of a new line from Port Deposit to Farmington, via Colora, Conowingo and Nottingham, where it will connect with the Elkton & Rising Sun line.

SALISBURY, MD.—The Salisbury Telephone Company has disposed of its charter, franchises, and properties to the Diamond State Telephone Company. The price paid by the Diamond State Company for the properties was $20,000.

BOSTON, MASS.—The Erie Telegraph & Telephone system made a net gain of 2369 subscribers in October, and since Jan. 1 15,968 subscribers.

DETROIT, MICH.—The Livingston County Telephone Company has been granted a permit to erect poles and wire at Brighton.

WAYNE, MICH.—The annual meeting of the People's Telephone Company of this place, held at Carleton Nov. 14, resulted in the election of Joseph Waltz, president; Frank L. Edwards, secretary and treasurer. The company was organized five years ago with a capital of $6,000, and is out of debt.

HATTIESBURG, MISS.—The People's Telephone Company has been incorporated with a capital stock of $30,000, by A. U. Montgomery, T. E. Ross, W. A. Dozier and others.

HELENA, MONT.—A new line has been completed by the Rocky Mountain Bell Telephone Company, giving much better connection between Helena and Spokane.

FAYETTEVILLE, N. C.—A combination is reported of all the telephone companies from Fayetteville to Washington, N. C., to be known as the Carolina system, with Howard F. Jones, of Wilson, N. C., as general superintendent. The exchanges included are: Wilson, with toll lines; Fayetteville, Tarboro, Scotland Neck, Greenville, Kinston, Goldsboro and Washington. Henderson and Rocky Mount are said to be the only towns not included.

WOODSTOWN, N. J.—The Borough Council has granted a franchise to the Interstate Telephone Company to erect its lines through the borough.

CLAYTON, N. J.—The Interstate Telephone Company has applied for permission to the Clayton Borough Council to operate its line in the borough.

HADDONFIELD, N. J.—The Township Committee has granted permission to the Delaware & Atlantic Telephone & Telegraph Company to lay underground conduits for its telephone system.

FLEMINGTON, N. J.—The Cherryville Telephone Company has elected the following officers: President, Samuel K. Everitt; secretary, Rev. A. E. Finn; treasurer, Andrew J. Pierson. The company has twenty-four members, all of whom are assessed $1 per year in lieu of the exchange service to Flemington.

TROY, N. Y.—The Rensselaer Telephone & Telegraph Company will erect a three-story brick building for its exchange and offices.

LESTERSHIRE, N. Y.—The new telephone company has about fifty subscribers in this village and will establish a local exchange.

NEW YORK, N. Y.—A special telegram from Aurora, Ill., says: "The Inter-State Independent Telephone & Telegraph Company was incorporated in New Jersey Thursday, Nov. 7, with an authorized capital of $3,000,000 and bond limit of $9,000,000, and the main office in New Jersey and branches in Chicago and Aurora. The first active operations will be in the States of Iowa, Illinois, Wisconsin, Michigan, and Indiana. The incorporators were men who are at the head of the Independent Telephone Company of Illinois. The board of directors and officers have not been chosen. The purpose of the Inter-State Independent Telephone Company is the unification of the independent telephone companies of the country, beginning in Illinois and including the independent projects which are on foot in Chicago. As the men who organized the Northwestern Telephone Company are the chief promoters of the Inter-State, into which the former will be merged, the history of the Northwestern is interesting. It is about a year old, but has 3200 telephones in its service, and links the Fox River Valley with the Mississippi. It has 634 miles of poles and 3600 miles of wire, covers Joliet, Aurora, and Elgin with a conduit system, and has a service in half a hundred towns in its territory." The incorporators are, it would appear, C. N. King, W. M. Greene and N. R. Vanderhoof, all of Jersey City.

JACKSON, OHIO.—The Jackson County Telephone Company increased its capital stock from $50,000 to $75,000.

XENIA, OHIO.—The Xenia Citizens' Telephone Company and the Clinton Telephone Company of Wilmington have completed a line between the two towns.

HILLSBORO, OHIO.—Citizens of this place have organized a Home Telephone Company and announce that the plant will be in operation before Christmas.

BELLVILLE, OHIO.—The Central Union Telephone Company is installing an exchange at Bellville and building new lines to New Washington and other towns in the vicinity of Mansfield.

SPRINGFIELD, OHIO.—The Miami Telephone Company is preparing to build two new direct toll lines, one of them to Washington Courthouse, by way of Jamestown and the other to Wilmington.

JACKSON, OHIO.—The Jackson County Home Telephone Company has increased its capital stock from $50,000 to $75,000. W. A. Sternberger is president and W. D. Jones secretary of the company.

DEFIANCE, OHIO.—The Northwestern Telephone Company, of Defiance, has increased its capital stock from $50,000 to $60,000. W. A. Sternberger is president and W. D. Jones, secretary of the company.

TOLEDO, OHIO.—Work has been started on the new exchange building of the Toledo Home Telephone Company located at the corner of Main and Fourth streets. The building will be of pressed brick and will cost $6,000.

NORTH RIDGEVILLE, OHIO.—The North Ridgeville Telephone Company of Lorain County, has increased its capital stock from $2,000 to $5,000, and will make improvements. J. P. Reidinger is president and C. P. Smith secretary of the company.

AKRON, OHIO.—A deal has been closed by which the Hartman Steel Company of New Castle, Pa., purchased the Cuyahoga Telephone & Wire Company, of Cuyahoga Falls. The price paid was $500,000. The new owners have already given orders for the improvement and enlargement of the plant.

CLEVELAND, OHIO.—The Cuyahoga Telephone Company has leased an office room at Rocky River and will install a branch exchange to take care of the service in that section of the county. Another new exchange is being opened up at Dover Center. Subscriptions from the urban district are coming in faster than they can be taken care of.

SOUTH CHARLESTON, OHIO.—A fight of several months' duration between the Central Union Telephone Company and the Citizens' Telephone Company at South Charleston, has resulted in a victory for the independent company. The Citizens' Company secured 280 subscribers and the Bell less than 30. The latter has taken out its system and sent the equipment elsewhere.

GENEVA, OHIO.—The Madison Telephone Company, with headquarters at Geneva, has completed extensive improvements to the Geneva exchange, among the improvements being the installation of a 300-drop North switchboard. At a meeting of the directors held a few days ago it was decided to make still further improvements, chief among them to be a new switchboard for the Madison exchange. New lines will be constructed between Geneva and Madison.

OTTAWA, ONT.—Application is to be made for the incorporation of the St. Lawrence Telephone Company. The company proposes to build a line between Sorel and Nicolet.

COTTAGE GROVE, ORE.—The Bohemia Telephone Company has been incorporated, with capital stock of $5,000 by P. J. Jennings, W. F. Morphy and J. W. Cook.

PITTSBURG, PA.—A deal for the merger of the Federal and Pittsburg & Allegheny Telephone companies of this city is understood to have fallen through. It may, however, be taken up again, under new terms. It is said that the hitch in the deal was in relation to the Maryland Telephone Company, of Baltimore, an affiliated corporation of the Pittsburg & Allegheny. The Baltimore and Pittsburg & Allegheny interests are said to have insisted on the Baltimore property being included in the deal, at terms which the Federal syndicate would not consider.

ORANGEBURG, S. C.—The Orangeburg & St. Matthews Telephone Company has been commissioned to construct a telephone line between these two points. The capital is said to be $1,000. Wm. C. Wolfe is interested.

DEADWOOD, S. D.—H. D. Maize, of Chicago, has purchased the franchises, etc., of the Harrison Telephone Company of this city.

MANKATO, S. D.—The Mankato Citizens' Telephone Company has completed its toll line between this city and the village of Good Thunder, Mapleton and Garden City.

PIKEVILLE, TENN.—The Gainsboro Telephone Company will put in an exchange at this place.

NASHVILLE, TENN.—Several gentlemen from Memphis who are interested in the Memphis Telephone Company were here conferring with local attorneys and others relative to establishing an independent telephone exchange in this city.

HILLSBORO, TEX.—J. S. Davis, of Blooming Grove, has purchased the Itasca telephone exchange.

FORT WORTH, TEX.—Fort Worth Telephone Company, composed of John C. Harrison, John Bardon, Martin Casey, of Fort Worth and Scott Johnson, of Chicago, has applied for a franchise for the construction of a $300,000 telephone system.

SALT LAKE CITY, UTAH.—The work on the installation of the new switchboard for the Rocky Mountain Bell Telephone Company will be commenced at once. This will be the fourth board since 1883. The new one will cost, with its battery plant, $75,000. It will be operated from a central energy plant.

RICHMOND, VA.—Southern Bell Telephone Company will expend $250,000 in improving and rehabilitating its plant.

SEATTLE, WASH.—A permit was taken out by the Independent Telephone Company for a one-story sub-station building to cost $35,000.

SEATTLE, WASH.—The Automatic Telephone Company, which is constructing an independent system in Seattle, is making good progress and expects to have its exchange in operation by April 15 next, giving service in the business districts.

ELECTRIC LIGHT AND POWER.

SAN FRANCISCO, CALIF.—The Riverside Light & Fuel Company was recently incorporated, with Riverside, Calif., as the principal place of business. Directors: G. H. Dole, W. W. Wilson, F. B. Braden, F. O. Johnson and W. F. Jordan. Capital stock, $150,000, subscribed in full.

WASHINGTON, D. C.—A charter has been granted to the Shenandoah River Electric Power & Light Company, with headquarters at Charlestown, Jefferson County, W. Va., to equip and operate an electric power plant on the Shenandoah River at Millville, to furnish electric power and light. The company has been organized by electing the following officers: Ex-Governor Lloyd Lowndes, president; Lloyd Lowndes, David Sloan and Daniel Annan, of Cumberland, Md., and Col. R. P. Chew and George S. Eyster, as directors. W. O. Norris was elected secretary and general manager.

AUGUSTA, GA.—A bill has been introduced in the Georgia House to amend the Augusta charter so as to give that city the power to regulate the price and quality of gas, electric light and power.

BLOOMINGTON, IND.—Trouble between the City Council and the People's Electric Light Company has reached a climax by the Council refusing to allow a claim of over $800 for light furnished by the company. The Council also took steps to annul the company's contract, on the ground that the agreement is not being complied with, in that the lights failed to be of 2000 candle-power. Litigation will follow.

LAFAYETTE, IND.—Capitalists of this city have purchased 55 acres of land on the Tippecanoe River, where they propose building a dam and race for a 2000-horse-power electric power plant. The river at this point makes a bend of six miles, while it is only a half mile across the land purchased, and it is across the bend the race will be constructed obtaining a fall of forty feet. Power from this plant will be furnished to all the surrounding towns and cities.

LOUISVILLE, KY.—The city will receive $17,650 for the franchise to furnish electric light, power and heat in the district bounded by Chestnut, Third, Fifth and Green Streets for ten years. The privilege was knocked down to McWilliams & Company.

BALTIMORE, MD.—The Patapsco Electric & Manufacturing Company, Ellicott City, Md., is developing power from the Patapsco River, for the purpose of supplying light and power for that city and surrounding districts. The construction of the power house and dam is about completed.

BOSTON, MASS.—The Charlestown Gas & Electric Company has entered into a contract with the Edison Electric Illuminating Company, of Boston, for a supply of current for lighting purposes. It is expected that the Charlestown Neck plant, owned by the Charlestown Company, will be abandoned.

DETROIT, MICH.—The Western Michigan Electric Light & Power Company has been incorporated, with a capital stock of $100,000. The incorporators are: Wallace Franklin, of Detroit; H. J. Conant and W. W. Churchill, of New York; Thomas F. Carroll and J. D. Hawkes, of Detroit. The officers are: President, J. D. Hawkes; Vice-President, T. F. Carroll; Secretary, Wallace Franklin; Treasurer, H. J. Conant.

ST. LOUIS, MO.—It is rumored here that the consolidation of the electric and gas lighting plants of St. Louis will be effected within the next thirty days.

BEVIER, MO.—At a regular meeting of the City Council, a bill was submitted to vote on a proposition to issue $10,000 bonds to put in electric light plant for the city.

ST. CHARLES, MO.—The St. Charles Electric Light & Power Company has been incorporated with a capital of $30,000 by J. D. Henseman, F. E. Niesen and W. J. Murray. Apparatus for the new plant has been bought.

CHARLOTTE, N. C.—Ten thousand dollars will be expended on improvements at the 4 C's Company's power plant.

ASHEVILLE, N. C.—The Sumner Son's Company has been chartered, with $50,000 capital, to establish, among other things, an electric light plant. Frank A. Sumner and others are incorporators.

PRINCETON, N. J.—The Hopewell Electric Light & Power Company, of Princeton, N. J., is preparing to erect a new plant.

JERSEY CITY, N. J.—The Inter-Ocean Electric Construction Company has been incorporated, to supply light, heat and power; capital, $3,000.

ALBANY, N. Y.—The Castile Electric Light & Power Company, of Castile, Wyoming County, capital $800, has been iucorporated. Directors: G. S. Vangorder, of Pike; M. H. Olin, of Perry, and J. M. Duncan, of Silver Springs.

ST. CLAIRESVILLE, OHIO.—A proposition to issue bonds to the amount of $25,000 to improve the municipal lighting plant has been carried by St. Clairesville citizens.

CINCINNATI, OHIO.—The Cincinnati Suburban Light, Gas & Electric Company, of Cincinnati, has been incorporated, with $10,000 capital stock, by Fred. W. Keam, Peter Keam, L. R. Keam and Henry Otterman.

YOUNGSTOWN, OHIO.—The John Smith Son's Brewing Company will make extensive improvements to its establishment. A large power plant will be erected and the refrigerating plant will be enlarged. L. R. Whyte, of Pittsburg, is engineer.

SHELBY, OHIO.—The City Council of Shelby has decided to dispose of the municipal lighting plant, which has been pronounced a failure, havign lost about $12,000 in the past year. The original cost of the institution was $25,000 and $18,000 has since been spent in repairs.

NORTH AMHERST, OHIO.—The Village Council of North Amherst is considering a proposition to build a combined municipal lighting and power plant. The plan is to furnish current to the proposed electric railway to South Amherst, which is being promoted by local people.

CLEVELAND, OHIO.—In connection with several large apartment houses and power buildings to be erected in Cleveland by John Hartness Brown, there will be a central power plant sufficiently large to furnish steam heat, power and electric light to the entire group of buildings, which will cover the block between Euclid, Murison, Chestnut and Erie Streets.

DELPHOS, OHIO.—A proposition to bond the town of Delphos for $25,000 to erect a municipal lighting plant has been defeated. The town is paying a private company $82 per year for 42 arc lamps, under a five-year contract, which expires June, 1903. A number of local citizens are organizing a company and will ask for a franchise to build another plant.

HUBBARD, OHIO.—At the recent election the citizens of the village of Hubbard voted down a proposition to bond the village in the sum of $8,000 for the purpose of rebuilding the municipal lighting plant which was burned early in the year. The situation is a peculiar one. Early last summer the Council declared in favor of a special election to decide on the matter. The election was held and the proposition carried, but when the sale of bonds was attempted it was found that the election had been held too soon after the passage of the resolution by the Council. A proposition has been made to furnish light by the Youngstown & Sharon Railway & Light Company, but its figures have been declared too high.

TOLEDO, OHIO.—The State Board of Public Works has granted permission to A. K. Detwiler, of Toledo, to build a pole line along the canal banks from Toledo to Maumee. Detwiler was the chief owner of the Toledo & Maumee Valley Railway which was recently sold to the Everett-Moore syndicate. The sale, however, did not include a 10,000-horse-power water plant operated by a 60 foot fall in the canal at Maumee. By stringing the wires to Toledo, Detwiler will enter into competition for city lighting with the local lighting plant. At present Toledo pays $90 per year for arc lights, and it is claimed Detwiler can furnish light at $30 per lamp, with private lighting, heat and power at correspondingly low prices.

PORTLAND, ORE.—A mining company composed of Portland capitalists, including Charles E. Ladd and Jonathan Bourne, is developing a great copper mining industry in Skamania County, Wash. There will be an extensive electric power transmission in connection with the company's operations. The company has secured water rights, giving it the control of large water powers on the upper tributaries of the Lewis and Washougal rivers. At one of the locations on the main Washougal River, it is estimated that 3000 horse-power can be developed for electric transmission to both the mines and mills.

ALLEGHENY CITY, PA.—The West Penn Light, Heat & Power Company, of this city, has been chartered, with a capital of $1,000.

GEORGETOWN, S. C.—The Georgetown Electric Company has been chartered by H. L. Chandler, president, and others. The company is capitalized at $50,000.

YORKVILLE, S. C.—A. & C. Wright, contractors for the dam for the Catawba Power Company, near Yorkville, have relinquished their contract after nearly a year's work. The water has overflowed the coffer dam 44 times since work began and between $10,000 and $15,000 has been lost by the contractors. The company will continue the work.

AUSTIN, TEX.—Several weeks ago the City Council purchased the plant of the Austin Water, Light & Power Company for $175,000. Following the purchase, ex-Mayor John D. McCall secured a temporary injunction enjoining purchase. Judge Morris, who granted the temporary injunction, has perpetuated the same, thus effectually preventing the purchase.

SALT LAKE CITY, UTAH.—Mr. F. M. Woods, of Victor, Colo., states that electric hoists are now being put in place on the properties of the Cripple Creek Gold Exploration & Battle Mountain Consolidated mining properties. The wires from the Pike's Peak power plant are already strung and the power is ready to be turned on as soon as the hoists are placed.

RUTLAND, VT.—With the exception of the extensive electric system to be installed, all the contracts for the equipment and building for the immense marble mill to be erected at Pittsfield, Vt., by the Rutland-Florence Marble Company of Rutland have been let. The plant will cost about $200,000.

LAMBERT'S POINT, VA.—The Norfolk & Western Railroad will place a new dynamo in its shops to increase the lighting capacity and furnish light for the recently completed coal pier.

THE ELECTRIC RAILWAY.

SAN FRANCISCO, CALIF.—The boilers in the power-house of the Oakland, San Leandro & Haywards division of the Oakland Transit Company's system at Elmhurst exploded recently, wrecking the power-house.

SAN FRANCISCO, CALIF.—Announcement is made of the incorporation in California of the Pacific Electric Railway, with $10,000,000 capital, to maintain 452 miles of interurban electric railway in Southern California.

SAN FRANCISCO, CALIF.—The Market Street Railway Company, San Francisco, has been bonded for $250,000 until Feb. 28 by a Baltimore syndicate represented by Geo. R. Webb. Three-fourths of the stock is to be bought for cash at a par value of $100 a share, if the system proves on examination by experts to be what it is claimed to be. The syndicate will spend $4,000,000 in improvements besides building interurban lines.

SAN FRANCISCO, CALIF.—Publicity was recently given to the plans of an Eastern syndicate, promoted by R. G. Hanford, of San Francisco, for an immense water supply and electric power transmission system. The water supply is to be found in the watershed back of Mt. Hamilton, Santa Clara County, Calif. On Isabel Creek, an impounding dam is to be built with a capacity of 1,000,000,000 gallons of water, giving a daily flow of 15,000,000 gallons. From the dam the water is to be conducted to the Calaveras Valley through flumes and piping. At the point selected for the electric generating station there will be an available head of 1200 feet and 3000 horse-power can be thus developed. Thence the water can be piped to various towns and cities about San Francisco Bay. It is claimed that all of the electric power that can be developed has been contracted for, for delivery to San Francisco, the distance of transmission being 47 miles.

INDIANAPOLIS, IND.—The Indianapolis & Martinsville Rapid Transit Company, has increased its capital stock from $100,000 to $750,000.

INDIANAPOLIS, IND.—Plans have been made for the building of an electric railway from Indianapolis to Lafayette, by way of Thorntown, Lebanon, Colfax, Stockwell and Dayton. The Lafayette & Indianapolis Rapid Railway, capital $250,000, has been incorporated by George P. Haywood, Henry A. Taylor, William C. Mitchell, C. E. Ruger and Adam O. Behm, of Lafayette.

LEXINGTON, KY.—A $7,000,000 syndicate to build interurban electric roads between Lexington and other cities of the central blue grass region has been organized here. The syndicate is backed by New York, Chicago and Detroit capital, and the following board of directors has been selected: Senator George D. Davis, chairman; Blaine Cavett, Edward E. Davis, Harold C. Beatty and Elliott G. Stevenson, of Detroit; Colonel W. F. Darwin, Chicago; M. C. Alford, W. J. Loughbridge and H. P. Headley, of Lexington. The chief office of the corporation will be at Lexington, and the main power plant, to be erected at a cost of $800,000, will be located here. The company's charter gives it the right to construct electric lines to Georgetown, Nicholasville, Winchester, Mt. Sterling, Versailles, Frankfort, Paris, Richmond and South Elkhorn.

LAUREL, MD.—The Berwyn and Laurel Electric Railway Company has been incorporated. The incorporators are Messrs. Frank Gosnell, Jesse Slingluff, George Weems Williams, Carroll T. Bond, and Ernest S. McElroy, of Baltimore. The capital stock is to be $500,000.

BOSTON, MASS.—The Railroad Commissioners have issued an order approving an issue of stock to the amount of $455,000 by the Springfield & Eastern (formerly Palmer & Monson) Street Railway Company, for purposes of paying and capitalizing the floating indebtedness from the cost of constructing and equipping the road, and the purchase of real and personal property.

ST. LOUIS, MO.—The St. Louis, Kirkwood & Manchester Railway Company, capitalized at $250,000, applied to the St. Louis County Court last week for a franchise to construct and operate an electric railway from St. Louis to Manchester, St. Louis County.

ST. LOUIS, MO.—It is said on excellent authority that the long-expected absorption of the suburban system by the Transit Company will be announced as a fact within the next two weeks. Negotiations are in progress between the representatives looking toward a consolidation.

MOUNT HOLLY, N. J.—A new plant is required by the Mount Holly & Burlington Traction Railway of Mount Holly, N. J., recently destroyed by fire. The property is owned by the Pennsylvania Railroad.

ELIZABETH, N. J.—There is a plan on foot for extending a trolley line from this city to Paterson, the route to be through Irvington, Vailsburg, East Orange and Bloomfield. A number of wealthy citizens of East Orange are behind the project.

AUBURN, N. Y.—Plans are being prepared for a 1500-horse-power plant to be erected by the Auburn Interurban Electric Power Company.

BROCKTON, N. Y.—At a public meeting in Brockton a franchise was voted W. J. Connors, of the *Buffalo Courier*, through Brockton, fifty miles from Buffalo, for his trolley line from Buffalo westward along the shore of Lake Erie.

NIAGARA FALLS, N. Y.—A dispatch from Niagara Falls of Nov. 17 says: "A fire at the Hydraulic Power Manufacturing Company's plant this afternoon destroyed the tower in which the wires are carried from the gorge to the top of the cliff. The Gorge Railway was without power to-day, and to-night many of the hotels are using lamps. Several large industries operated by power from the hydraulic plant will be interrupted in their business for a week. The property loss is about $5,000.

NEW YORK CITY.—One of the chief improvements incident to the installment of electricity on the Manhattan Elevated Railroad's system will be the new 110th Street station, which will be at Manhattan Avenue, on the great curve from Columbus Avenue and 109th Street to Eighth Avenue and 111th Street. The construction has already been begun, an excavation for the foundations of the station being now in evidence, as well as some of the steel frames and girders for the structure. One hundred thousand dollars will be the cost of the station, which is to be the finest as to equipment and convenience in the city. Electric elevators, eight in number and of large size, will take the passengers up to the waiting rooms. In the building erected along with the station will be one of the sub-power stations of the line, but it will be only a distributing station, with no smoke or noise.

SIDNEY, OHIO.—The Western Ohio Railway Company has secured a franchise in Sidney after a controversy lasting several months.

CLEVELAND, OHIO.—The passenger receipts of the London (Ont.) Street Railway for the month of October were $10,102.69, a gain of $845.87.

CLEVELAND, OHIO.—The passenger earnings of the Northern Ohio Traction Company for the month of October were $42,706.51, a gain of $4,972.21.

CLEVELAND, OHIO.—The receipts of the Detroit & Port Huron Shore Line for the month of October were $25,352.68, a gain of $710.25 over the same month last year.

CLEVELAND, OHIO.—The passenger receipts of the Toledo Railways & Light Company for the month of October were $79,605.05, a gain of $7,543.80 over the same month last year.

WATERVILLE, OHIO.—The Toledo, Waterville & Southern Railway Company has brought condemnation proceedings against the village of Waterville to secure a right of way through the town.

CLEVELAND, OHIO.—The Everett-Moore syndicate has formally taken possession of the Canton-Akron Railway, despite the statements of the Canton and Akron directors of the company that the road would not be sold.

CLEVELAND, OHIO.—It is stated in Youngstown that the Salem Railway (steam) a coal road which is owned largely by Myron T. Herrick, of Cleveland, is to be used as a nucleus for a traction line which will extend from Youngstown to East Liverpool.

WAPAKONETA, OHIO.—The Schaffer Construction Company, of Wapakoneta has been incorporated, with $25,000 capital stock, by S. A. Hoskins, W. S. Rogers, A. E. Chaffer, C. T. Kolter, and J. A. Wertz. It will take up electric railway construction.

CLEVELAND, OHIO.—The Council at Monroe, Mich., has refused to grant a franchise for an extension of the Toledo & Monroe Railway, thereby making it impossible for the present to connect this line with the Detroit & Toledo Shore Line, which will be part of the same system.

RAVENNA, OHIO.—Judge Robinson at Ravenna has dissolved an injunction brought by the Pennsylvania Railway restraining the Northern Ohio Traction Company from crossing its tracks near Ravenna. This is the last of several litigations which have barred the completion of the Kent-Ravenna extension.

CLEVELAND, OHIO.—The passenger earnings of the Detroit United Railways for the month of October were $260,098.96, a gain of $33,524.21 over the same month last year. The receipts were divided between city and suburban lines as follows: City, $227,698.49, a gain of $25,402.26; suburban, $32,400.47, a gain of $8,121.95.

CLEVELAND, OHIO.—The Everett-Moore syndicate will build a feeder line for the Detroit & Toledo Shore line, extending from Monroe to Dundee, fourteen miles west. The syndicate has secured a right of way extending on both sides of the river valley, the most available route. Other parties have been figuring on a similar line, but the Cleveland people quietly secured the desired right of way.

AKRON, OHIO.—The directors of the Northern Ohio Traction Company will meet in Akron and arrange to take over the Canton-Akron Railway, which has recently been purchased by the Everett-Moore syndicate. It is probable that an extension to Canal Dover and New Philadelphia will be authorized, as rights of way and franchises for such a line were secured with the purchase of the Canton-Akron line. It is stated that the Akron-Massillon line will not be built this year, but the Canton-Akron will be pushed to completion. Negotiations are still under way for the purchase of Canton-Massillon Railway and the city lines of Canton and Massillon.

CLEVELAND, OHIO.—The Pomeroy-Mandelbaum syndicate has secured from the Lorain County Commissioners at Elyria, a franchise for a railway from Wellington to the county line, being part of the proposed Cleveland, Ashland & Mansfield Railway. T. Y. McGrey, promoter of the Mansfield, Savannah & Wellington Railway, appeared before the Commissioners at the same time to secure an extension of a franchise over the same route, their franchise having expired some time ago from failure to commence work. When he heard of the grant made to the other company, he did not make application, which fact, it is said, will prevent the McGrey Company from securing entrance to Wellington. Mr. Pomeroy says he is somewhat mystified as to the intention of the other company in building a parallel line, but he claims his people are not worrying over the situation. The Pomeroy-Mandelbaum syndicate has thirty miles of road south of the disputed territory, practically in operation, while from Wellington to Cleveland the line has been in operation for more than a year. All right of way for the connecting link of thirty miles has been secured, and when this strip is placed in operation, the Cleveland syndicate will have undisputed entrance to Cleveland as well as control of the through business, leaving little for the other company, it is claimed.

TORONTO, ONT.—United States and Canadian capitalists have formed a company to build and operate an electric railway from Toronto to Cornwall, with a branch line from Brockville to Ottawa.

OTTAWA, ONT.—It is stated that Mr. Van Dyke, of Grimsby, Ont., is negotiating for the purchase of the Belleville street railway, with the object in view of extending that railway system to the town of Trenton, Ont.

THE AUTOMOBILE.

THE SALEM AUTOMOBILE COMPANY was recently incorporated in Salem, Oregon, by T. L. Davidson, F. N. Derby, Amos Strong and H. G. Guild; capital stock, $3,000. Among its objects is to operate automobiles in Salem and between Salem and the Morningside addition and other towns.

NEW AUTOMOBILE COMPANY.—Mr. Francis T. F. Lovejoy, late secretary of the Carnegie Steel Company, of Pittsburg, has established an automobile company under the name of the Banker Brothers Company. The company will manufacture and sell automobiles. Not much has been given out by those interested in the new concern, but it is believed that it will develop some of the French and German types of automobiles. The company has a nominal stock of $50,000.

AUTOMOBILE CLUB OF AMERICA.—Forty-four members of the Automobile Club of America attended its annual meeting on Nov. 18. The regular nominees for officers, approved by the Board of Governors, were elected without opposition as follows: Mr. Albert R. Shattuck, president; General George Moore Smith, first vice-president; Mr. Edwin Gould, second vice-president; Mr. Harry Payne Whitney, third vice-president; Mr. Jefferson Seligman, treasurer, and Mr. Albert C. Bostwick, Mr. Winthrop E. Scarritt and Mr. James L. Breese governors for three years. The governors will elect the secretary, and will choose Mr. S. M. Butler, the present incumbent. The secretary reported a total of 351 members, of whom 293 are active. The club is in a very prosperous condition.

STAGES FOR CHICAGO.—Electricity probably will supplant the omnibus horse in Chicago in the conveyance of persons to and from the railway stations and the hotels. Such is the belief following the announcement that a syndicate has been formed to purchase and take over the property and business of the Frank Parmelee Company, which does almost all the transfer business. The men behind the project are John J. Mitchell, president of the Illinois Trust & Savings Bank; Roger B. McMullen, C. H. Randle, president of the Gulf Company, and James B. Wilbur, president of the Royal Trust Company; Norman B. Ream and J. C. Schaffer. The Parmelee concern has been in existence for almost half a century. Frank Parmelee began business in Chicago in 1853, with three or four old omnibusses. The company at present is controlled largely by John W. and Charles K. Parmelee, sons of the founder of the system.

LEGAL.

ROENTGEN RAY DAMAGES.—Dr. John Weldon, of Willimantic, Conn., has won a heavy damage suit against Otis Clapp & Sons, of Boston, from whom he bought an X-ray outfit. Dr. Weldon asserted that the defendants guaranteed that their apparatus would not burn, but that during the first experiment he received a burn that laid him up for twenty-two months and nearly caused his death. A jury in the Federal Court, Boston, awarded him a verdict of $6,750.

CHICAGO FRANCHISE TAXES.—Mr. Henry Crawford, acting for the Union Traction Company and the Chicago Consolidated Traction Company, has filed in the United States Circuit Court at Springfield, Ill., an application for an injunction to restrain the State Board of Equalization from assessing the franchises of the corporations for the year 1900 as ordered by the writ of mandamus recently issued by Judge Thompson. The Union Traction Company and the Chicago Consolidated Company were among the public utility corporations affected by Judge Thompson's decision, whereby it was calculated millions of dollars in taxes would accrue to the State. Relief is sought by the corporations under the fourteenth amendment to the Constitution of the United States, which provides that private property shall not be taken without due process of law. The complaint alleges that the process which the Supreme Court of the State of Illinois outlined as legal is not lawful and, therefore, in violation of the fourteenth amendment.

OBITUARY.

MR. M. H. REDDING, Assistant Superintendent Western Union Telegraph Company's central cable office in New York City, died last week, after a sickness of two weeks.

MRS. S. E. MORSE.—Mrs. Sarah Elizabeth Morse died at the home of her daughter, Mrs. Franz Rummel, in Berlin, Germany, on Thursday, Nov. 14. She was the widow of Professor Samuel F. B. Morse, of telegraph fame. Mrs. Morse, who was a Miss Goodrich, was a deaf mute, but she was taught to articulate by the Rev. Dr. Gallaudet, whose wife was an intimate friend.

MR. OMAR J. AUGE, formerly lieutenant First United States Volunteer Engineers, died in the J. Hood Wright Hospital, New York, on Nov. 10, from diseases contracted in Porto Rico while in the military service in 1898. He was in the employ of the Central Cable office in New York. He was an exceptionally fine operator and a man of great refinement and of sterling character. He spoke several languages fluently.

CHARLES H. L. KNIGHT died last week in New York City, after an illness of four months. He had been employed by Tiffany & Company since January, 1897, as chief engineer, in charge of the steam and electric plant. For six years prior to his engaging with Tiffany & Company he was in charge of the electric lighting plant of the *New York Herald*. He had also been attached in a like capacity to James Gordon Bennett's steam yacht Namouna.

PERSONAL.

MR. G. A. NISBET, formerly of the Electrical Appliance Company, 39 Cortland Street, New York, has joined the selling forces of the General Incandescent Arc Light Company.

MR. E. B. BAKER, long time general superintendent of the Southern New England Telephone Company, has resigned, but it is said that the resignation does not take effect until next May.

MR. B. H. KROGER, a Cincinnati wholesale grocer, is credited with the intention of establishing big electrical bread bakeries there and selling bread at three cents a loaf. He has been in New York city the past week looking for bakery sites in the metropolis.

MR. SAMUEL INSULL, president of the Chicago Edison Company, is again in New York, and reports favorably on conditions. The demand for current in Chicago far outruns any previous season, and Mr. Insull has had to do some hard work preparing for the winter season.

PROF. RICHARD O. HEINRICH, general manager of the European Weston Electrical Instrument Company, Limited, of Berlin, is now in this country on a trip for consultation, etc., with Mr. Edward Weston, but expects to return to Germany this week. He and a host of old American friends have found his stay on this side altogether too short.

PROF. W. F. STRATTON.—At the Manufacturers' Club of Philadelphia on Nov. 18 Prof. W. F. Stratton, president of the National Bureau of Standards, explained the advantages of the new bureau to business men. He advocated the adoption of the metric system, and, after a discussion, the club directed its Legislative Committee to prepare a memorial to Congress endorsing the system.

MR. E. B. OVERSHINER, president and treasurer of the Swedish-American Telephone Company, of Chicago, has been a visitor to New York during the past week, taking in the Horse Show with his wife, while attending also to various business matters. While here in the East he has also visited Philadelphia and Pittsburg. He reports an active telephone trade, the field now expanding more rapidly than ever before.

MR. SAMUEL W. GLOVER, president and treasurer of the Post-Glover Electric Company, Cincinnati, Ohio, has surprised his many friends by slipping away and taking unto himself a wife. The young lady who is now Mrs. Glover was Miss Mary Grace Herbert, of Asbury Park, N. J. The wedding took place on Nov. 20, and Mr. and Mrs. Glover are now settled at home in Avondale. Mr. Glover's friends extend their hearty congratulations.

MR. C. T. YERKES has sailed from Southampton for New York. He stated that he was going to the United States for two months on business connected with underground transit construction in London. He expects that the decision of the Arbitration Commission concerning the electrical system will be announced shortly, and it is understood that he is ready to place his contracts for equipment at once. He has been subjected to many vexatious delays in his business in London. Should the Arbitration Commission decide against the direct current system—the system advocated by Mr. Yerkes—the latter will withdraw altogether from the field, according to a statement made by a director of the Charing Cross, Euston & Hampstead Company.

MR. G. H. McKIBBIN.—The appointment of George N. McKibbin as first lieutenant in the First Signal Corps, National Guard, N. Y., to fill the vacancy caused by the resignation of First Lieutenant Chas. F. Lembke, Jr., was recommended recently by Major General Chas. F. Roe, commanding National Guard, New York. Lieutenant McKibbin was thereupon examined, in accordance with the recent regulations, by the board for the examination of signal officers consisting of Major Frederick T. Leigh, Signal Officer; Captain Oscar Erlandsen, First Signal Corps, and Captain Chas. B. Baldwin, Second Signal Corps, and passed brilliantly, especially in the technical subjects—electricity, telephony, telegraphy, etc., and soon afterward received his commission and took the oath of office.

MR. A. J. WURTS at the November meeting of the Electric Club of Cleveland, held Nov. 6, delivered an interesting and instructive address on the Nernst lamp. The meeting was held for convenience in the Electricity Building of Case School of Applied Science and was attended by fully 300 members of the club and students of the school. The principles and construction of the lamp were fully explained and illustrated with parts of lamps. Mr. Wurts stated that the newly organized Nernst Lamp Company will make both indoor and outdoor lamps in one, two, four and six glower sizes. At present they are constructed only for parallel work, but it is expected that before long series lamps will be produced. Many technical questions were asked regarding the action of the lamp under various conditions. In a number of instances Mr. Wurts admitted that he was unable to give information on different points, since the experiments of those who have developed the lamp have been along commercial lines and purely with a view to bringing out in the shortest time a lamp which would be practical and economical for commercial purposes.

Trade Notes.

THE LAWTON-BEATTIE ELECTRIC COMPANY, Cincinnati, Ohio, has recently taken a contract for the electric equipment of the Wiborg & Hanna lumber plant.

VAN CHOATE.—The plant of the old Van Choate Company at Foxboro, Mass., is being sold. The company made great protestations, but never did anything. Down Boston way it is regarded as a rank big swindle.

THE FORT WAYNE ELECTRIC WORKS has recently installed two 300-kw 550-volt belted generators in the plant of the Rapid Transit Company, Chattanooga, Tenn. The contract was taken by the Cincinnati office.

THE PORTLAND COMPANY, Portland, Me., is overwhelmed with orders just now. The company has in course of erection a new three-story brick building which has been found necessary to accommodate its electrical work.

LIGHT READING.—The second of the series of leaflets on "Light Reading" has been issued by the New York & Ohio Company, Warren, Ohio. Some pointed facts about Packard incandescent lamps are given, and the light-giving qualities of these lamps are humorously illustrated.

WATER has always given more or less trouble in the filtering of waste oil. The Burt Manufacturing Company, of Akron, Ohio, has perfected an attachment for its Cross oil filter which successfully overcomes this difficulty—an improvement which makes an already good filter better.

U. S. METAL POLISH.—Mr. George W. Hoffman, Indianapolis, Ind., manufacturer of "U. S." infallible metal polish paste, reports that business is steadily improving and good reports are coming in from his branch houses in New York, Chicago and San Francisco, and from foreign agents.

KELLOGG SWITCHBOARD & SUPPLY COMPANY, Chicago, Ill., has recently issued a variety of excellent trade literature relative to its telephone apparatus. It includes Bulletin No. 4 relative to small switchboards for central battery work, and No. 5, devoted to Kellogg transmitters and receivers.

MACHINE TOOLS.—The Garvin Machine Company, New York, has issued a leaflet containing an up-to-date list of good modern second-hand machine tools in stock. It also has on hand over 400 new machine tools of every description ready for immediate delivery. The company is always ready to trade, or buy.

OKONITE.—The use of Okonite wire for telephone work has been increasing steadily, and has now reached such proportions that in order to supply the demand the Central Electric Company is compelled to carry in Chicago a large stock of this grade of wire as well as Okonite wires and cables for lighting purposes.

COAL HANDLING APPARATUS.—An interesting pamphlet has been issued by the C. W. Hunt Company, New York, describing the means of handling coal from ship to furnace at the Lincoln power station of the Boston Elevated Railway. Hunt equipment is used in this work. The pamphlet is illustrated with views of the apparatus.

MICANITE PATENTS.—The Mica Insulator Company, of 218 Water Street, New York City, has lately been directing attention to its long list of patents secured in the United States, Great Britain and Germany, protecting its special processes, etc., with regard to the article known as "Micanite" and the manufacture of electrical insulation from mica sheets.

THE AMERICAN MINIATURE & DECORATIVE LAMP COMPANY, 436 Broome Street, New York, announces that its new forty-eight page catalogue is now ready for distribution. The Chicago branch of this company, at 254 Madison Street, was destroyed by fire on Nov. 14, in consequence of which all orders are being filled direct from the New York factory.

THE VIADUCT MANUFACTURING COMPANY, of Baltimore, Md., has lately brought out a new district call box for the Postal Telegraph Commercial Cable Company. This box is finished in blue enamel with white lettering, and is one of the most attractive call boxes on the market. The Viaduct Company is thoroughly up to date with its apparatus, as an examination of its catalogue will show.

THE KEYSTONE ELECTRIC COMPANY, Erie, Pa., is making a line of high grade dynamos and motors. Its line of belted dynamos ranges from 1½ to 300 kilowatts and its motors from 1¾ to 400 horse-power in standard machines. The capacity of the direct connected generators range from 5½ kilowatts at 450 r. p. m. to 900 kilowatts at 95 r. p. m. The company is prepared to build larger belted machines for special purposes.

SALES ORGANIZATION.—The W. W. Whitehead Company, Chicago, Ill., has just effected a sales organization and opened sales offices at 541 Marquette Building, Chicago. The sales heretofore have been handled through the company's main office at Davenport, Iowa, where the company's engine and boiler building shops are also located. The Chicago office will undoubtedly prove a great convenience to the company's customers.

T. H. SYMINGTON & COMPANY.—Pending the completion of many tests of their specialties in various parts of the country, the business of T. H. Symington & Company, of Baltimore, Md., will be conducted as heretofore from their Baltimore office under the direct supervision of Mr. Harvey Middleton, managing director. Mr. W. R. Bean has been appointed general inspector of the company, and will look after these tests.

BELT CONVEYORS.—The Robins Conveying Belt Company, 15 Park Row, New York City, has just issued a new catalogue descriptive of its belt conveying machinery. It consists of 72 pages, printed in two colors on heavy paper. The illustrations are mostly half-tone reproductions of photographs of typical installations, there being seventy-six of these, as well as a large number of other illustrations of parts and arrangements of the system.

DISSOLUTION OF PARTNERSHIP.—The partnership at Saginaw, Mich., conducted under the firm name of the Porter-Morse Company, was dissolved on Nov. 1 by mutual consent. The business will be continued at the same place by Mr. Wellington S. Morse, under the firm name of the Morse Cedar Company. This concern manufactures cedar products, including ties of cedar, hemlock and oak for steam and electric railways, telephone and telegraph poles, etc. It has four distributing yards.

THE D. M. STEWARD MANUFACTURING COMPANY, Chattanooga, Tenn., reports the sales of its lava insulators for the month of October to be the largest in its business experience of thirty years. The foreign sales have increased one-third and orders have just been received from the General Electric Company and the Western Electric Company, the largest ever received from these two concerns. Mr. R. B. Steward, the vice-president of the company, looks after the Eastern branch of the business, with offices at 107 Chambers Street, New York.

CLARK AUTOMATIC TELEPHONE SWITCHBOARD COMPANY.—In the item in last week's issue regarding the installation in Providence, R. I., of an intercommunicating telephone system in the Commercial National Bank in that city, by the Clark Automatic Telephone Switchboard Company, the types effected a curious transformation of a part of the company's title. It was rendered "The Clark Automobile Telephone Switchboard Company," the word "automobile" having been evolved from the word "automatic" by some mysterious process.

OSBURN FLEXIBLE CONDUIT COMPANY, 21 Park Row, New York City, whose new "Flexduct" conduit for interior wiring was recently illustrated and described in these pages, has issued a very neat and tasteful brochure devoted to this new material in the art. The conduit is shown in detail, each part being brought out clearly in the cuts and text, and the "argument" is well presented. A copy of this interesting trade pamphlet should be in the hands of every one of our readers, and can be obtained on application. The company reports a rush of inquiries and orders, and is already very busy at its Hoboken factory.

UNITED TELPHERAGE COMPANY, 20 Broad Street, New York City, have added to their excellent trade literature two new pamphlets illustrative of the practical uses of ærial electric transportation. No. 17 is largely devoted to their telphers, particularly those of the center bearing type, and to their electric hoist attachment, for which they are receiving many inquiries and orders. No. 18 has as its theme telpherage as applied to docks, piersheds, freight stations, etc., and shows by means of admirable diagrams and outline sketches how a telpher line, dispensing with a track along the floor, so often blocked and encumbered with merchandise, will handle large quantities of freight with wonderful economy and dispatch. Indeed, it is impossible to study these circulars and not realize that a great revolution in such work has been begun by this concern.

SHOW CASE LIGHTING.—The proper illumination of goods in show cases means much to the dealer, and gives such advantage, that its importance is now generally recognized. The lighting fixture for show cases manufactured by Thomas E. Clark, manager Electric Service & Appliance Company, 166 Randolph Street, Detroit, Mich., has several meritorious features. It is portable and applicable to any show case, and it brilliantly lights the goods in the case, at the same time the source of light is screened from the eyes of the observer. The reflector is of metallic construction and the fixtures and wiring meet the requirements of the highest grade of material required by the rules of the National Board of Fire Underwriters. The lamps used have a long, narrow cylindrical bulb, formed to take the least space vertically, but to give the most horizontal illuminating surface. A circular in colors issued by Mr. Clark tells all about this fixture.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED NOVEMBER 12, 1901.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, Times Bldg., New York.]

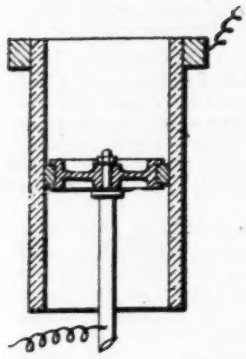
686,245. ELECTRICAL RESISTANCE; J. F. Bachmann and A. Vogt, Vienna, Austria-Hungary. App. filed Nov. 22, 1898. The resistance material is in the form of a tube through which the contact passes in the form of a piston.

686,246. ELECTRICAL RESISTANCE; J. F. Bachmann and A. Vogt, Vienna, Austria-Hungary. App. filed Dec. 12, 1899. A graduated resistance comprising a number of divisions each of a different specific resistance and all of the same cross-section and composed of mixtures of a conductive and non-conductive material.

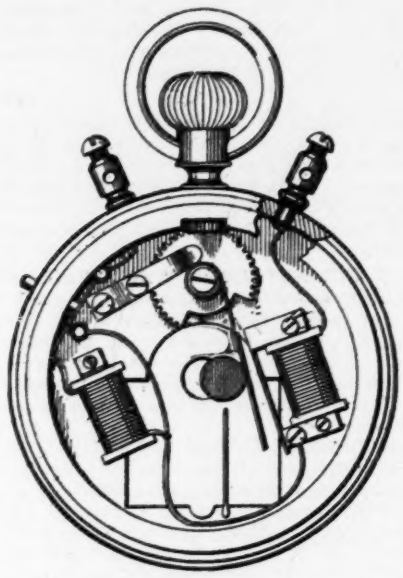
686,288. ELECTRICAL STEAM BOILER; C. E. Griffing, Hamilton, Ohio. App. filed April 2, 1900. Electrical heating coils extend through the boiler parallel with the tubes.

686,295. LIQUID INTERRUPTER FOR ELECTRIC CURRENTS; John O. Heinze, Jr., Revere, Mass. App. filed April 24, 1901. A tube at one end is drawn out to a small bore and submerged in an electrolyte within a lead cylinder. The cylinder serves as one electrode and a platinum wire within the tube as the second electrode. By means of a crank an up-and-down motion is imparted to the platinum wire. As the platinum wire is pulled up into the glass tube it is insulated from the liquid by the gas which is formed through the electrolysis in the small part of the tube, and the current is broken. A commutating device on the crank shaft may be utilized for changing the relative positions of the insulating means and the electrode, and thus to control the circuit interruption.

686,330. ELECTRIC TRANSFER APPARATUS; H. H. Porter, Jr., Chicago, Ill. App. filed April 1, 1901. An elevator cage adapted to carry a car from one floor to another and equipped with a trolley conductor above, and a conducting floor below, so that when the cage reaches a landing, the two conductors will join corresponding conductors on the floor and the car will be able to propel itself out onto the floor.



686,245.—Electrical Resistance.



686,561.—Battery Gage.

686,349. ELECTRIC CONTROLLER; G. J. Scott, Philadelphia, Pa. App. filed Jan. 22, 1901. The contact brush is carried by an endless chain and is moved successively over pairs of contacts.

686,350. STRONG CURRENT PROTECTOR; A. A. Seeley and C. Silet, Chicago, Ill. App. filed Feb. 4, 1901. A tripping circuit breaker controlled by a magnet.

686,395. APPARATUS FOR ELECTROCOPPERING METALS; E. L. Dessolle, Levallois-Perret, France. App. filed March 6, 1900. (See Current News and Notes.)

686,402. MAGNETIC SEPARATOR; T. J. Greenway, East Adelaide, South Australia. App. filed Oct. 12, 1899. The crushed ore is caused to travel from the center of a rotating horizontal disk to the edge, the magnetic particles being meanwhile retarded by an electro-magnet, so that the said particles will be thrown from the edge of the disk at a different point from that which the non-magnetic particles leave it.

686,416. ALTERNATE CURRENT TRANSMISSION; W. M. Mordey, Westminster, Eng. App. filed March 16, 1900. (See Current News and Notes.)

686,419. CONDUIT FOR ELECTRIC WIRES; E. D. Page, Brooklyn, N. Y. App. filed April 2, 1901. A conduit the cover of which is corrugated crosswise, so that it will be strong and at the same time permit the cover to bend to suit the shape of the conduit.

686,434. DISTRIBUTION OF ELECTRIC CURRENTS; E. Arnold, O. S. Bragstad and J. L. La Cour, Carlsruhe, Germany. App. filed Jan. 26, 1901. (See Current News and Notes.)

686,443. ROSETTE FOR ELECTRIC WIRING; J. H. Cramphorn, Medford, Mass. App. filed June 14, 1901. Passages are arranged to lead the wires from the binding posts at the side to the central orifice.

686,459. ELECTRIC CUT OFF FOR EMERGENCIES; J. H. Johnson, Newark, N. J. App. filed April 25, 1901. A cam standing beneath the handle of a switch can be pulled in either direction by a rope to open the circuit in case of emergency.

686,507. ELECTRIC METER; J. Cauderay, Lausanne, Switzerland. App. filed Sept. 17, 1900. Details.

686,525. ELECTRIC FURNACE; J. H. Morley, Springfield, Mass. App. filed June 18, 1900. (See Current News and Notes.)

686,526. ELECTRIC BELL; J. J. Mossop, Philadelphia, Pa. App. filed Feb. 20, 1901. The mechanism is confined within the gong, the hammer being a reciprocating bar attached to the armature.

686,541. THIRD RAIL SAFETY SYSTEM FOR ELECTRIC RAILROADS; C. Schlechtiger, Nantasket, Mass., and R. Bingham, Philadelphia, Pa. App. filed March 19, 1898. The switches controlling the current to the feeder section, are moved mechanically by the car.

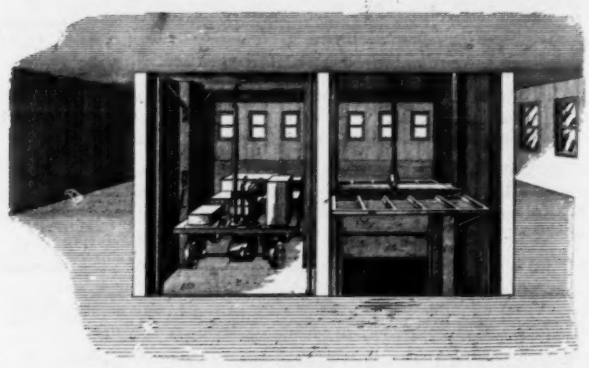
686,551. ELECTRIC FURNACE; A. Simon, Bordeaux, France. App. filed Feb. 27, 1901. (See Current News and Notes.)

686,558. APPARATUS FOR MANUFACTURING TUBES, PIPES, ETC.; E. Thomson, Swampscott, Mass. App. filed Feb. 15, 1897. The seam in the tube is welded by laying a strip of welding material along the abutting edges of the tube, then applying a current to heat the parts to a welding temperature and then pressing them together.

686,561. BATTERY GAGE; C. R. Underhill, Montclair, N. J. App. filed Feb. 19, 1901. A pocket device by which the voltage, amperage and resistance of a battery can be calculated from the readings obtained from it.

686,583. ELECTRIC CIGAR LIGHTING APPARATUS; C. J. Brosnan, Springfield, Mass. App. filed Dec. 3, 1900. Details.

686,605. AUTOMATIC TENSION COUPLING AND SOUND DEADENER; E. L. Grauel and S. H. Gallagher, Carthage, N. Y. App. filed June 24, 1901. At ends of a conductor are attached to caps fixed to the respective ends of a coil-spring, the wires leading through the spring in opposite directions. The spring thus acts as a tension device and the whole thing is embedded in fibrous material to deaden the vibration of the wire.



686,330.—Electric Transfer Apparatus.

686,609. INSULATING SUPPORT FOR ELECTRIC WIRES; R. G. Heringray, Muncie, Ind. App. filed March 11, 1901. A pin threaded at each end carries at one end an insulator for the wire, and at the other end an overhanging, water-shedding petticoat insulator.

686,632. APPARATUS FOR LOCATING METALS, MINERALS, ORES, ETC.; Augustus F. McClatchey, Chicago, Ill. App. filed Dec. 26, 1900. Apparatus for a method consisting in establishing an alternating current circuit through a definite distance of the earth and measuring its resistance, then establishing similar circuits through the same distance at various other points, and comparing the measurements.

686,644. ELECTRIC RAILWAY; L. Woods, New York, N. Y. App. filed Nov. 3, 1900. Electro-magnetic appliances for making the switch-action positive in sectional railway systems.

686,645. ELECTRIC RAILWAY; L. Woods, New York, N. Y. App. filed Feb. 1, 1901. A modification of the preceding.

686,651. TROLLEY WIRE HANGER; G. W. Gurten, Piqua, Ohio. App. filed March 21, 1901. Details.

686,668. ENGINE STOP MECHANISM; J. H. Cary, Providence, R. I. App. filed March 5, 1901. The movement of the governor is used to close circuits for controlling the engine.

686,671. ALARM GAGE; E. Fortier, Kankakee, Ill. App. filed Jan. 19, 1901. The device closes a circuit for the maximum and minimum pressures.